



Training design and materials for increasing the bioeconomy capacity of regional stakeholders

Deliverable 6.4

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Table 2: Document History



ABBREVIATIONS

BSAT: Bioregional Strategy Accelerator Toolkit

CEE: Central and Eastern Europe

DoA: Document of Agreement

EFSA: European Food Safety Authority

EU: European Union

FAO: Food and Agriculture Organization

LCA: Life Cycle Analysis

NGO: non-governmental organizations

R&D: Research and Development

RTO: Research and Technology Organization

S-LCA: Life Cycle Social Analysis

SME: Small and Medium Enterprise

TRL: Technology Readiness Levels

WP: Work Package

PROJECT PARTNERS

CIRCE: Fundación CIRCE Centro de Investigación de Recursos y Consumos Energéticos

DBFZ: DBFZ DEUTSCHES BIOMASSEFORSCHUNGSZENTRUM GEMEINNUETZIGE GMBH

WR: STICHTING WAGENINGEN RESEARCH

META: META GROUP SRL

AKI: AGRARGAZDASAGI KUTATO INTEZET

NAK: MAGYAR AGRAR-, ELELMISZERGAZDASAGI ES VIDEKFEJLESZTESI KAMARA

EPC: EPC Project Corporation Climate. Sustainability. Communications. mbH

DRAXIS: DRAXIS ENVIRONMENTAL S.A.

BZN: Bay Zoltán Nonprofit Ltd. for Applied Research

UNFU: Ukrainian National Forestry University

CAGPDS (former CAPDER): Junta de Andalucía – Consejería de Agricultura, Pesca y Desarrollo Rural

MAE: Mazovia Energy Agency

USB: University of South Bohemia

CCB: Chemie Cluster Bayern GMBH

SPRING: Sustainable Processes and Resources for Innovation and National Growth

POWER4BIO project (818351)

Deliverable 6.4 – Training design and materials for increasing the bioeconomy capacity of regional stakeholders



EWI: VLAAMS GEWEST (Government of Flanders)

SUA: Slovak University of Agriculture in Nitra

ECRN: European Chemical Regions Network (ECRN) e.V.



PUBLISHABLE SUMMARY

The aim of the training courses and webinars developed under the task 6.3 of the POWER4BIO Project was two-fold. Firstly, to contribute to increase the bioeconomy capacity of regional stakeholders involved in the project Secondly, to promote new bioeconomy initiatives in any other region across Europe as the participants in the training courses and webinars were open, no-restricted to POWER4BIO partners.

Due to the Covid-19 situation the initial planning had to be adapted to transform the 4 face-to-face training courses to 11 online sessions. Thus, the sessions were shifted from a day and a half day courses into two-three sessions per bio-base product group (bioenergy, feed&food, biomaterials and biochemicals), with a duration approximately of 2 hours per session, taking place in two-three different weeks.

The structure of content aimed to cover updated data in each of the 4 bio-based product group. Also, to tackle all elements which could help regions and any type of practitioner interested in those areas dive into existing cases. So, the sessions were very much content driven in the definition of key elements to elaborate. Lastly, the identification and selection of cases focus on those examples, which were illustrative and explained in enough details to be understood and potentially, had a high degree of replicability.

In addition, the interaction with the POWER4BIO regions, in particular the CEE regions have been emphasised in the definition of the sessions. The POWER4BIO regions, as main beneficiaries of the training sessions and webinars, participated in an open dialogue in the design of the sessions. Length, content, structure, practical issues were among others, topics exchanged with the 4 RTOs in charge of the training sessions, one per bio-based product group. Then, the final material has been also pre-defined with the support and communication of the regions, in the search of a practical approach in the selection of contents and scope of the materials to include.

The exchange of opinions resulted in five modules, which were used in the definition of the 4 bio-based product groups training sessions.

- Roadmap to promote the implementation of Bioenergy/Biochemicals/Biomaterials/Food projects
- Success cases examples. From technological solution to business: boosting technology transfer and entrepreneurship in EU regions.
- Keys for success and synergies/cooperation scheme. Open access to (cross-border) research and test facilities.
- High potential value chains /potential bio-applications to develop in the region.
- Legislation to consider and financing opportunities. Combining public and/or private funding instruments to finance bio-based business models and policy alignment: towards a coherent and supportive framework for regional bioeconomy.

Some specific outcomes per bio-base product group and general conclusions have been extracted from the activities developed within the task. This is related to competences and abilities needed to exploit the opportunities offered by the bioeconomy, in which training programmes are essential. The generated material (both training sessions and webinars) within this task represents a very useful tool for capacity building purposes, but also as a dissemination channel to draw the attention on success examples in the field of bioeconomy.



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1 INTRODUCTION

The updated European Bioeconomy Strategy in 2018 includes the relevance of Bioeconomy Education subject, in particular in the Action 2.4 “Promote education, training and skills across the bioeconomy”. This action aims at reducing skills shortages and mismatches across the bioeconomy by supporting development of new and updated training programmes. The aim is to respond to the diverse and evolving needs of stakeholders and sectors in the bioeconomy. Education is crucial to understand the challenges and embrace the opportunities of the bioeconomy. Shortening the gap between academia and industries, facilitating collaboration and design of shared training programmes is mandatory to align educational paths with labour market opportunities.¹

The identification of the skills and technologies required (WP3) as well as the implementation of regional hubs for the development of bioeconomy strategies have been tackled in POWER4BIO in collaboration with regional partners and local stakeholders based on the specific needs and resources of the territories (WP5). These two previous and still on-going tasks have fed into the definition of what is required to develop new and improved skills related to bioeconomy. Also, which values and knowledge might be provided to the bioeconomy value chains, in particular, and in line with previous WPs within the POWER4BIO, 4 bio-based product group, for instance bioenergy, biomaterials, feed&food and biochemicals.

Skills and competences of workers must be also improved by training programmes to match the new opportunities, technologies and procedures that are rapidly emerging in the bioeconomy are through life-long learning. Thus, the importance of training in bioeconomy is essential to develop skills needed to support the new and emerging approach, particularly with regards to higher education and the development of entrepreneurship programmes. Lastly, it is urgent to increase the capacity of implementation of roadmaps, projects, and initiatives in general to put into practice new processes.

Also, it is critical to increase the awareness of sustainable circular bioeconomy in Europe, stimulate the debate, knowledge sharing and mutual learning to address bioeconomy related challenges and opportunities and facilitate networking among stakeholders.

In addition, entrepreneurs, SME’s and start-ups should be supported by dedicated educational programmes to seize the business opportunities represented by the bio-based economy.¹

All those elements have been addressed in this task 6.3, with 2 different actions, training courses and webinars. Both actions aimed to be used as knowledge platforms to transfer the knowledge gathered in WPs 2,3 and 4. On those previous WPs of the POWER4BIO project, valuable inputs were analysed and developed to help overcome barriers in several related domains such as technologies, business models, successful schemes examples, etc.

2 APPROACH

The aim of the training courses and webinars developed under this task was to contribute to increase the bioeconomy capacity of regional stakeholders (participating regions), but also to promote new bioeconomy initiatives in any other region across Europe.

The priorities and interests of the participants will be shared, keeping the information and contacts of the speakers included in the courses available to use by the participants according to their interest in the future.

¹ https://www.bioeconomy-library.eu/wp-content/uploads/2020/03/02_LIFT_FactSheets_education.pdf



The information gathered and developed during the project was used to generate the materials of the trainings. The expertise and knowledge acquired has been condensed and structured to define the content of the training material. The information relative to the characterization of the regions included in the WP2 of the project has served as model to make visible the needs and priorities of regions with different level of development. Additionally, teleconferences were organised with the regions to present the structure and content of the training and webinars and get their feedback.

A training course was designed for each bio-based product group targeted (Bioenergy, Food and Feed, Biochemicals and Biomaterials) going in depth in the technological, financial and legislative state of the art. The content of the trainings was designed to bring value to different actors along the bioeconomy value chain and with the regional dimension in mind, from researchers to advisors and business stakeholders. Special attention was paid to CEE interests as they are expected to be the main beneficiaries of the final materials developed.

Two main actions were carried out with the objective to complete this task. On one hand, online training courses replacing face-to-face sessions. Due to the Covid-19 crisis, training courses had to be reformulated into an online version. This new proposal consisted in developing specific modules for each bio-based product group using an online conference platform to communicate remotely.

Every training course was developed under the technical criteria of the responsible RTO's with the general coordination of CIRCE as task leader. Every RTO was in charge of the development of the content for every bio-based product group (WR for Food and Feed, CIRCE for Bioenergy, BZN for Biomaterials and DBFZ for Biochemicals).

The success of the sessions developed was qualitatively measured through list of participants and their contributions in the webinars.

On the other hand, five regional webinars addressed to European East countries were organized. They were thought to be used as a training material for CEE regions of the Power4Bio regions for knowledge transfer purposes to different stakeholders. The webinars were routed on the training materials developed. To reach out to the largest number of potential beneficiaries, webinars materials were developed by summarizing the training materials produced and translating them.

2.1 Barriers to overcome

Due to the Covid-19 situation the initial planning had to be adapted to transform the in-house and physical training courses into online courses. The first course of the series of 4 in total was organized by DBFZ at the beginning of the pandemic crisis. This first exercise required to change a day and a half course by 3 sessions taking place in 3 different weeks. It allowed to maintain the interest and commitment from participants due to the vast number of teleconferences taking place under this situation. So, the final agenda and the practicalities to organise them had to be appealing and adapted to the new reality too.

For the following courses, the possibility to organise back-to-back the training sessions to technical cross-visits of the POWER4BIO, if the health situation would have allowed us to do it this way, was still considered. However, at some point of time, it was agreed that the 3 training sessions to follow would be organised online and aside from the technical visits to not overlap and not increase the time of technical visit. The agendas of those events were already long and no more time was allowed to avoid existing, and then, less effective sessions. Hence, the training sessions were designed besides any other event of the project.

The new approach was then adopted. All sessions were developed along two or three days, separately and in several weeks (not necessarily in a row). In short, the 4 face-to-face courses were re-structured in 11 online sessions, two-three per bio-based product group day with a duration approximately of 2 hours per session.



Due to the specificity of the topics, the search of speakers for every session was challenging. Experts belonging to the RTO's responsible of the webinars were included as presenters in the agendas in some cases. CIRCE proposed a structure of trainings divided in five blocks to address the most relevant content. This structure was initially discussed and agreed with the technical partners, but also regional partners and partners involved in the dissemination of the trainings. The topics were selected based on the interest of the regions and, in all cases, industrial examples were included.

In some cases, the search of industrial success cases for some bio-applications was challenging due to the innovative nature of the solutions, keeping still a low TRL to produce some bio-products. Other aspects such as heterogeneity and diversity in the use of biomass to produce bio-products, as well as the so different characteristics between regions in Europe increased the difficulty to select the topics. Nevertheless, consent was reached when presenting the contents of the training course to the regions and technical partners.

Because of the search of useful material for the regions was one of the main objectives of the task, different formats of presenting the information were used. In the first training developed by DBFZ live presentations were used and the whole meeting was recorded, generating only one video including all sessions. Due to some contingencies in the connection, the material produced presented some imperfections. Thus, different strategy was implemented for the following trainings to develop training material recorded and available at a better quality. Therefore, for the following training course, developed by WR (Food and Feed) the material to expose was previously recorded and then presented during the meeting. This material had a very good quality, allowing a better dissemination between assistants to the training.

This method developed by Wageningen University was also used in the Bioenergy training. For the Biomaterials training the presentations were carried out in real time, considerations were taken into account, so the final quality of the recordings was sufficient.

Being aware of all these barriers, the trainings courses developed under this task tried to create a general vision of the state of art for the production of biochemicals, food and feed, bioenergy and biomaterials tackling the main aspects affecting the bioeconomy projects implementation and the main interests of the regions.

2.2 Structure of content

Due to the Covid-19 situation the content and structure of the material had to be adapted to the new situation. New agendas of the events were proposed including new dates and times. The structure of the content was designed with the objective of identifying and presenting key aspects for the launch/start-up of success bioeconomy projects and initiatives of innovation for the valorisation of biomass. The aim was to facilitate the exchange of ideas and experiences of the assistants from an inter-sectorial and multidisciplinary perspective. Also, identifying key areas and facilitators elements to inspire and motivate initiatives and new projects in the field of bioeconomy.

The content of the training courses was addressed to professionals of diverse types of entities, such as companies, universities, research and development centres, innovative agencies, associations, local entities, technological platforms from a wide variety of sectors (such as environmental, wastes, chemical, energy, consultancy, construction, research and development and engineering).

For the elaboration of baselines of content, similar activities developed in the projects at regional, national, and international level and topics included under a broader umbrella of contents extracted from reports on bioeconomy, European research and development projects on circular economy, drafts of bioeconomy strategies



in European East and West countries and industrial cases were reviewed^{2,3,4,5}. Then, each RTO responsible for each bio-based product group, with the help of the baselines, was in charge of the development of the materials with the support of CIRCE as leader of the task, keeping in all cases the same general criterion. The alignment and harmonised approach in the definition of the 4 bio-based product group was instrumental to facilitate the understanding of the final generated material.

The design of the trainings courses was based on the priorities mentioned in the DoA, according to the needs of the regions reported under WP2 and WP5. From the preliminary analysis already undertaken of the POWER4BIO regions (task 2.1) the following modules were proposed in the DoA.

- Sustainability in the bio-based value chains
- Combining public and/or private funding instruments to finance bio-based business models
- From technological solution to business: boosting technology transfer and entrepreneurship in EU regions
- Open access to (cross-border) research and test facilities
- Policy alignment: towards a coherent and supportive framework for regional bioeconomy

CIRCE based on the modules previously mentioned above (DoA) and with the help of the information reported by the regions through, developed a first draft of structure of content including five modules. These modules were presented firstly to the technical partners in order to get their agreement. Slight adjustments were implemented when needed. Secondly the training modules were presented to the regional partners since the training courses were to be carried out jointly with the cross-visits and thirdly to the partner involved in the dissemination.

The five modules of content proposed were as follow:

1. Roadmap to promote the implementation of Bioenergy/Biochemicals/Biomaterials/Feed&Food projects.
2. Success cases examples. From technological solution to business: boosting technology transfer and entrepreneurship in EU regions.
3. Keys for success and synergies/cooperation scheme. Open access to (cross-border) research and test facilities.
4. High potential value chains /potential bio-applications to develop in the region.
5. Legislation to take into account and financing opportunities. Combining public and/or private funding instruments to finance bio-based business models and Policy alignment: towards a coherent and supportive framework for regional bioeconomy.

Three of these modules, technological solutions, cooperation schemes and policy and funding instruments were considered essential to implement a new project in the field of bioeconomy therefore they were considered as the base/pillar to structure the contents.

² REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the implementation of the Circular Economy Action Plan. Brussels, 4.3.2019

³ COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS. Sustainable bioeconomy for Europe: consolidate the connection between the economy, the society and the environment. Brussels, 11.10.2018

⁴ ANNEX to the COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS. The European Green Deal. Brussels, 11.12.2019.

⁵ COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS. The European Green Deal. Brussels, 11.12.2019.



Regarding technological module, the collection and presentation of data from different success industrial cases was carried out. The availability and diversity of industrial/experimental data was quite a challenge in some cases. In this sense, in some cases it was not possible to collect the required data due to its unavailability.

All data presented will serve to develop techno-economic analysis of feasibility as well as studies helping the strategic planification of initiatives. Also, the technological solutions exposed in the trainings for every bio-based product group have associated the development of new business models in order to open it up to the market, implementing new innovative solutions and covering gaps of value chains.

The importance of the inter-sectorial collaboration when it comes to developing a new bioeconomy project was addressed in the cooperation schemes' module. As part of the exercise, several collaborative scenarios were included in the training sessions such as;

- Analysis of secondary raw material supply.
- Certitude of a market for recycled materials.
- Development of specifications for new recycled materials.

The third module was designed to tackle legislative and financing instruments. The following elements were part of the training sessions in the 4 bio-based product group:

- Ensuring the requirements for current standards and regulations.
- Development of new standards for new products.
- Broadening the use of wastes and by-products as secondary raw material in new products and processes.
- Processing environmental permits for pilot projects.
- Adapting the current grant and subsidies in the bioeconomy field for each specific case.

The use of the information presented should serve to analyse and tackle studies regarding identification of barriers/opportunities, viability, and development of recommendations.

3 METHODOLOGY

The methodology followed for the design and organization of the trainings consisted in ten steps.

1. Definition of the aim of the task,
2. Review of the task 2.1 and the deliverables 3.1, 4.2, 4.3, 4.4 and 5.2 within WP3, WP4 and WP5 with the aim of adapting the content of every training and the selection of the topics to the interests, priorities and needs of the regions,
3. Development of a first draft concerning the structure of content,

CIRCE was in charge of these first three activities. From then, every RTO managed and set up each training (DBFZ-Biochemicals, CIRCE-Bioenergy, WR-Food and Feed, BZN-Biomaterials) under coordination of CIRCE and with the help of EPC as dissemination partner. The following steps were implemented:

4. Collection and analysis of the information to be included.
5. Production of a first draft of content to be discussed.
6. Selection of speakers and design of the tentative agenda.
7. Advanced draft of the presentations.
8. Final design and organization of the technical session-final agenda.
9. Dissemination of the sessions.
10. Implementation of the training.



The online format of the trainings required and resulted in an increase in number of hours spent in organising the sessions; coordination with speakers, preparatory meetings to get familiar with the IT system, development the recordings, before and during the sessions and the update and preparation phase afterwards. In turn, the new format, allowed to reach out to a larger number of participants. Both from the POWER4BIO partners and their regions, but also opened the training to other audiences beyond the POWER4BIO regions 'stakeholders.

3.1 Development of content

The design of a methodology includes different fields of activities as the definition of a field or sphere, an area of interest, innovations involved, facilitators and key aspects^{3,6,7}. In this specific case, the objective of the training courses was defined under the following fields of activity; rural field; biomass and bioproducts area; innovations related to processes; products and services; facilitators as financing and regulations benefits or incentives and right conditions to the re-investment; re-manufacturing or recycling and others more related to governance and knowledge.

The criterion for the selection and development of the content for the training courses was the application of a methodology covering as much key aspects as possible. These key aspects as well as the pilot and industrial success cases exposed as examples, tried to cover all the value chain for the projects of valorisation of biomass, but also other residues to bioproducts.

The way in what the content/information was designed and developed was designed thinking in solving questions concerning their final use/exploitation and benefits/advantage by the participants. For the main blocks of content these questions were addressed as follows:

Information contained in each training module		
Block of content	Use/Exploitation	Benefits/Advantages
Success cases examples. From technological solution to business: boosting technology transfer and entrepreneurship in EU regions	Performing viability analysis, development of indicators and management models. Improving the valorisation options of infra-used resources or wastes. Replacing fossil technologies for renewables alternatives and other options with reduced impact. Promoting the competence of stakeholders.	To know how to establish technology transference between actors of different sectors or parts of the value chain. To know how to promote the implementation of new technologies or processes.
Keys for success and synergies/cooperation scheme. Open access to (cross-border) research and test facilities	Participating in technical-professional platforms and in the thematic forums/meetings, as well as with clients and providers to set-up a new bioeconomy project.	To know how to optimize the use of resource throughout a cooperative value chain. To know how to promote new collaboration initiatives between actors from different sectors to

⁶ COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS. Innovation at the service of sustainable development: one bioeconomy for Europe. Brussels, 13.2.2012.

⁷ HOW THE BIOECONOMY CONTRIBUTES TO THE EUROPEAN GREEN DEAL. November 2020. European Commission



	<p>Involving to the final users in the design of the requirements of the innovations by means of interviews and collaboration groups.</p> <p>Testing of commitment of the different actors of the value chain in the production and consumption of news products and services.</p>	<p>produce new value chains in order to make the most of the infrastructures-used resources.</p> <p>To know how to establish right collaboration frameworks.</p> <p>To know how to develop technical cooperation models between regions to improve the innovations in processes/products.</p> <p>To know how to start-up circular business models that require of user collaboration/cooperation.</p> <p>To know how to participate in technical tasks of the projects (for example in the separation of wastes).</p>
<p>Combining public and/or private funding instruments to finance bio-based business models and Policy alignment: towards a coherent and supportive framework for regional bioeconomy</p>	<p>Collaboration in a regulation analysis together with public entities and legislation authorities.</p> <p>Support in the development of recommendations.</p> <p>As base of information for the promotion of normalization committees.</p>	<p>To know current standards/regulations requirements.</p> <p>To identify the lack of standards in relation with innovative/new products and services, therefore including activities in the projects in order to promote the development of new standards.</p> <p>To identify the lack of standards destined to characterize materials from wastes.</p> <p>To analyse the possibility of using waste and by-products as secondary raw material in new products and processes.</p>

Table 1. Summary of the uses and benefits of the information contained in every module

The industrial success cases exposed in the courses included different level of development but always focused on the guidelines of the new bioeconomy policies and priorities of the regions, covering their specificities and making easier the access and the understanding of the material produced. These examples included mostly technical data concerning raw material (volume, composition, location, availability), process (environmental data and energy consume as for example greenhouse gases, cost of electricity and/or fuel), products and market (demands, competitors, costs) in order to define the requirements of the business models in future bioeconomy projects.

3.2 Training material and dissemination

The training courses produced a total of 11 multimedia presentations in English, 8-9 presentations for every course developed along two or three days replacing the components of the 1-day face-to-face training course.



In the case of the first training concerning biochemicals production developed by DBFZ the presentations were performed in live and the entire session was recorded. Unfortunately, some technical issues were detrimental to the quality of the final recorded material. Thus, the rest of the training were developed differently to improve the quality of the final material. The use of pre-recorded presentations in PowerPoint format used during the second training focused on Food and Feed bio-applications developed by the Wageningen Research was used as reference model for the third and fourth trainings focused on production of the bioenergy (CIRCE) and biomaterials (BZN) respectively.

The use of pre-recorded presentations allowed for keeping the final material produced clear of imperfections. The final material was uploaded in POWER4BIO's website and in partner's and relevant network's websites. It was widely spread out using the networks of POWER4BIO's partners. The dissemination of the training courses was carried out by EPC partner. To this end, tailor-made banners were produced for each training session. These events were disseminated via social media channels and between the main actors in the field of bioeconomy at European level. One example of the banners used in the dissemination activities for the biomaterials training is presented below. (Figure 1).



Figure 1. Example of the banner for biomaterials training

Then, one additional written summary of every training was generated by CIRCE. As mentioned in the DoA, POWER4BIO explored the possibility of integrating the training material into the curriculum of the educational programmes offered within the participant regions (and beyond) by academic stakeholders of the RBH. To this end, and especially focusing on the CEE regions, 5 regional events have been organised and will take place before the end of the POER4BIO project. The 5 CEE regions of the POWER4BIO will introduce the webinars materials generated from the training courses of the 4 bio-based product groups to targeted stakeholders in their respective regions. To this end, several meetings have been held and chaired by CIRCE to identify the best approach, framework, targeted audience and content of the seminars.

These regional webinars are meant to disseminate the generated training material for knowledge transfer purposes. Due to the reschedule of all the training programs and due to the COVID crisis, the training materials have been developed slightly later than planned, and not organised back-to-back to technical visits as initially scheduled. Thus, the webinars, which required to be scheduled after the last training to collect the 4 bio-based product groups' courses, were also delayed. Nevertheless, the webinars are already planned and designed jointly with the 5 CEE POWER4BIO representatives. As a preliminary information of these webinars, the titles and participants have been identified at this stage, subject to final details to be fine-tuned in the following weeks.



Regional webinars		
Region	Title of webinar	Targeted audience
Ukraine	“Sustainable Bioenergy”	Students
Czech Republic	“Sustainable Bioenergy”	Students
Hungary		Food industrial departments of the Hungarian Chamber of Agriculture; interested members of the Chamber.
Slovakia	“Boosting bioeconomy in Nitra region. Bioenergy and Food and Feed solutions”	Representatives of the Slovak Agriculture and Food Chamber. Research and academia experts. Stakeholders from business and members of clusters. Representatives of regional and local governments in Nitra region.
Poland	Implementation of the idea of bioeconomy in Mazovia in the agriculture, waste management and bioenergy sectors.	Representatives of local government units and public finance units.

Table 2. Preliminary agenda for regional webinars in the 5 CEE regions of Power4Bio for educational purposes.

Webinars’ materials in English and translated versions will be uploaded in the following webpage:

<https://power4bio.eu/power4bio-regional-webinars>

The regional webinars will focus on one of the bio-based product groups. Each region has selected the most interesting bioapplication training material in view to their own interests and targeted community for such a webinar. Nevertheless, the webinars will also be used to disseminate and introduce the other bioapplications (bioenergy, biochemicals, food&feed and bioenergy) training materials developed in this task in each CEE region.

4 DEVELOPMENT OF TRAININGS

The transition to a bioeconomy will increase demand for biomass feedstock to replace fossil-derived products especially for chemicals and materials. Also, bioenergy will be produced mostly where other renewable energy sources, particularly solar and wind-based energy, are not an option and where energy generation from co-products in biobased chains are more efficient and sustainable. The increased demand for biomass feedstock to produce food and non-food products imposes challenges and requires smart solutions to increase the efficient and circular use of biomass.



In this context, the increase of training skills aimed at satisfying the demand and addressed to bio-economical actors are essential. Diverse content throughout four training courses were developed in this task whose main conclusions are presented in the sections 4.1-4.4.

Agendas, presentations and videos of the 4 training sessions are available in the following links:

Access via POWER4BIO website

Biochemicals

<https://power4bio.eu/webinar-series-biochemicals>

Food and Feed

<https://power4bio.eu/training-webinar-food-and-feed>

Bioenergy

<https://power4bio.eu/webinar-series-bioenergy>

Biomaterials

<https://power4bio.eu/webinar-series-bio-based-materials>

Access via POWER4BIO you-tube channel

<https://www.youtube.com/channel/UCGVO-5nRZiPeXdp3OpPN2hw>

In each of the training sessions, a registration procedure was implemented to have access to the suitable link.

Training courses participants				
Training course	Biochemicals	Food and Feed	Bioenergy	Biomaterials
Number of registrations	149	143	53	92
Type of Stakeholder	University, Industry, Cluster, Agency, Governmental administration, Association, NGO, Start-Up.	University, Industry, Agency, Governmental administration, Association, NGO, SME, Start-Up.	University, Industry, Agency, Governmental administration, Association, NGO, SME, Start-Up.	University, Company, Cluster, Agency, Regional/governmental administration, Association,
Type of Stakeholder	University, Industry, Cluster, Agency, Governmental administration, Association, NGO, Start-Up.	University, Industry, Agency, Governmental administration, Association, NGO, SME, Start-Up.	University, Industry, Agency, Governmental administration, Association, NGO, SME, Start-Up.	University, Company, Cluster, Agency, Regional/governmental administration, Association,



Table 3. Number of registrations and nationalities of the participants per training course.

In each of the bio-based product group sessions, different specific topics were discussed. In the following subchapters, general messages and conclusions per training are listed and elaborated.

4.1 Biochemicals

Reducing the dependency on fossil-derived resources is essential transition towards reducing greenhouse gas emission among other environmental threats that a continuation of fossil-based resources will suppose. Alternatives for the production of platform and final-use chemicals, as well as polymers from renewable natural resources present an opportunity towards the de-fossilisation of the economy. Thus, the development of adequate substitutes for current most used chemicals as well as new and innovative products, together with the required scientific knowledge and technological development (pre-processing, conversion, final product), constitutes key pillars of the current EU Bioeconomy Strategy in pursue of reaching climate mitigation targets.

In transition towards sustainably produced biochemicals, lignocellulosic biomass is of key importance, due to its abundance and non-food competitive nature. However, still pose challenges in terms of technological capabilities for its valorisation, facing limitations with regards to their scalability, flexibility and cost-efficiency of conversion processes. EU policies drive current advances in biochemicals sector and development of biorefineries concepts at national and regional level, for instance by setting as goal the reduction of 30 % of oil-based chemicals by 2030. This entails the development of novel value chains, that can ensure stable biomass availability, with the sustainable considerations for growing, harvesting and transporting lignocellulosic biomass, as well as the socio-economic effects (new skill sets for nascent bioeconomy sectors, adaptability of farmers and biomass suppliers to new value chains, understanding of civil society about bioeconomy and new created possibilities).

Bio-chemicals and in particular building block (platform biochemicals) and their potentiality to produce refined biochemicals and biomaterials are a key area of bioeconomy development still in constant innovation. Emerging technologies are constantly being arising and production methods are being refined or newly develop to provide a competitive edge in price or quality capabilities against incumbent (fossil-based) chemicals. Key motivation for a biochemicals training session has been:

- An overview about biochemicals potential at EU level.
- As an area in development, the sharing of current industry, R&D experiences, as well as support for pilot facilities for testing and supporting the scalation of proved concepts is of great interest for all bioeconomy community.
- Analysis of current challenges and aspect under consideration to attain sustainable biochemicals production. This includes work skills, areas of development, biomass supply, financial and policy supporting mechanisms and sustainability indicators.

In a series of five training courses, experts from POWER4BIO consortium and international experts in the fields of biochemicals (research, industry and agencies) gave insights about the status of biochemicals at EU level, innovative practices at industry level and research advances. Likewise, POWER4BIO partners presented funding opportunities and supporting policies for the sector.

The main objective of this session was to present the state of the art and identify potential paths of development according to biochemical actors, industry and R&D experiences and in complement with possible supportive actions such as EU projects, pilot plants, testing facilities, policy and financial mechanisms.

The main areas of development for biochemicals were presented (cosmetics, adhesives, surfactants, paints & coatings, agrochemicals, lubricants, solvents, fibres and plastic/polymers), as well as proposed actions to drive forwards the development of bio-based chemicals in those groups with consideration of sustainability aspects.



Interregional cooperation has proven to be a driver for projects that bring forward the development of joint bioeconomy pilots, with already perceived benefits for regions, industries. Mainly focused on conversion of biomass into biobased building blocks, agrochemicals and the validation of business models for sustainable, circular and innovative value chains for biomass valorisation.

Specific R&D advancements were presented during the second training day mainly for the development of biorefineries concepts and recent developments in bioplastics. A section during the same day was dedicated to sustainability monitoring, presenting possible methodologies using LCA and S-LCA for an integrated sustainability assessment of regional bioeconomy networks (including biochemicals value chains) and sustainability indicators for the bioeconomy.

Participants were representatives from Industry including SME, start-ups, R&D community, universities, clusters and industry associations, governmental representatives, agencies and NGO's.

Nine presentations were provided, divided in five sessions and over three days – 30th of June, 7th of July, 14th of July -. A short summary of the presentations are as follows:

- Biochemical Status-quo in the EU and roadmap (30.06.2020): the project RoadToBio carried out during May 2017 to April 2019 studied the status quo of biochemicals components of interest and with the support of stakeholder's participation (Chemical Industry, NGOs, Administrative Bodies, Governments) a roadmap per bio-chemical product were develop, analysing existing barriers, opportunities and enablers. The presentation got into detail for three specific product groups: cosmetics, agrochemicals and paint & coatings, describing their sub-products, sustainability drivers, other additional drivers, barriers and the size of addressable market (as identified during 2018). Strategic actions agreed with stakeholders engaged during RoadToBio included measures at short, mid and long-term, which respond to the encountered barriers.
- Bioeconomy Pilot – Interregional cooperation on innovative use of non-food Biomass (30.06.2020): The following cases and topics were presented; the Lombardy Green Chemistry Association, the effect of Smart Specialization Strategy for setting interregional networks, the need of better alignment among regions and leveraging public-private funding, and the case of Vanguard Initiative. Demo cases of importance, facilitated through The Bioeconomy Pilot, such as the bio-aromatic demo-case based, the lignocellulosic biorefinery demo-case, among others were presented.
- Fertilizers from renewable resources (07.07.2020): Introduced the activities of the Germany SME, Biofabrik – The green biorefinery GmbH. Biofabrik has developed a decentral Bio-refinery concept for the valorisation of grass for its use as fertilizer, which has been proven since 2014 and operational until the date. The Biofabrik biorefinery concept uses existing infrastructure and resources for grass-processing industries for the reduction of cost to a minimum. The business model was presented in general terms.
- Exemplary R&D projects for the development of biorefineries (07.07.2020): The area of biorefineries of DBFZ presented exemplary technical projects for the transformation and valorisation of lignocellulosic biomass. Starting with project KomBiChem for the development of fine and platform chemicals by a combination of chemical and biotechnological processes, for product of interest such as C5-sugars, Xylonic acid, Malic acid Furfural, Furfuryl alcohol, Tetrahydrofuran, 5-(Hydroxymethyl) Furfural and Furan-dicarboxylic acid. The testing of Organosolv method in laboratory, pilot development, concepts for implementation and final assessment were presented. Secondly, project CapAcid was presented, which analysis a biorefinery concept based on anaerobic fermentation of wet biomass. The concept includes the bioenergy generation with CHP plant and the use of sub-products from biogas reactors for the production of biochemicals components and fertilizer.
- Integrated sustainability assessment of a regional bioeconomy network (07.07.2020): A model for the analysis of a whole bioeconomy network at regional network, for the analysis through use of LCA and S-LCA methods of sustainability of regional bioeconomy value chains.
- Indicators to monitor and evaluate the sustainability of bioeconomy (07.07.2020): Indicators for the monitoring system for bioeconomy developed by FAO, together with the JRC, developed as an



international guidance to support countries and stakeholders. Simple approach but that based on SDGs indicators, including circularity principles from standards, certificates and labels still remain robust to be followed internationally.

- How to finance bio-based chemicals and its value chains using ESIFs? (14.07.2020): Design and access to funding schemes to set up financial products for biobased chemicals enterprises. Practical aspects to implement financial instruments at national and regional level and take advantage of existing ones. Lessons learned for loans, guarantee and equity instruments as well as presentation of relevant best practices.
- Supporting policies for bioeconomy – focus on biochemicals (14.07.2020): Needs, limitations and opportunities in policy instruments for the biochemicals sector. A closer look to policy instruments that facilitate and set requirements to the development of potential value chains. Results from Task 4.2 from POWER4BIO, presenting good policies examples.

The main outcomes and challenges of the sessions were:

1. Understanding the market to grasp possible opportunities for bio-based chemicals as well as understanding the regulatory barriers is key to be able to discuss with stakeholder possible key action to take.
 - a) A common barrier to all biochemicals groups is the competition with well-established fossil-based biochemicals products.
 - b) Main focus for the roadmap presented were the chosen nine biochemicals products and the possible action to respond to existent drivers.
2. The Vanguard Initiative.
 - a) Being the Vanguard initiative an European association lead by a political commitment, the participation is made among regions (not directly from companies or universities by themselves). Regions decided the number of pilots in which they are interested to join.
 - b) Among the initiative, a great experience has been made with the Bioeconomy Pilot. Main learnings and success factors identified have been:
 - i. To be able to cooperate in a consortium without overlapping of the partners skills, taking also into consideration the real industrial facilities.
 - ii. Starting from market applications (demand-driven approach) rather than from the technologies to be use is key to be able to reshape technologies to assure sustainability of process and deal with consumption volatility.
 - c) Specially for plastics (market segment) at the moment there is a bigger technology push than market pull. But while market opportunities open, for instance driven by the single use plastic directive, the real challenge is to be able to respond with increasing demand with a sustainable concept. End-use management is also a key area, still in development.
3. Success factors from the experiences of biochemical industry.
 - a) Using previously established technologies and valorisation of waste biomass (waste grass, oils or plastics in the case of Biofabrik) has been key for the business model, which emphasize the reduction of environmental hazard as an added value to the product. Also, the simplicity of the product has represented an advantage, easy understanding of it by consumers/users.
 - b) Seasonality plays a key role in the production. Planning production taking this limitation into account is key to having enough products in winter, when biomass is not available.
4. Main results from both presented projects are:



- a) From project KombiChem: The conversion of beech wood into, dissolving pulp, xylose monomers, malic acid, xylonic acid, and phenolic BCD-oligomers was successfully transferred from lab scale to pilot scale (TRL 5), improving the efficiency of the organosolv process (especially lignin recovery) significantly. Success factors: the availability of technology on different technology scale, trying first in lab scale and then being able to scale to pilot facility. Communication with project partners was key for the understanding.
 - b) From CapAcidy: the main achievement was to prove that a biorefinery concept can stem from an existing and in operation biogas facility, using sub-products (cascade use). Success factors: participation of industry partners which providing their expertise and informing about specification of final products interesting for market. Dialogue with industry partners with genuine interest in applying the resultant technology/process is key.
5. Factors for the valorisation of food waste is to explore all components, as much as possible not wasting any parts of the recovered waste. Applying the cascade use principle is key in waste valorisation.
 6. The Model SUMINISTRO provides a management tool based on sustainability indicators for a cluster region, covering the entire product life cycle and the three dimensions of sustainability. Their results can be used by managers for setting the cluster, networks as well as regional strategies.
 - a) The effects of regional energy transitions are not yet considered into the model.
 - b) The implications of different processing scales (TRL 6-7) have been considered for the model.
 7. Sustainable indicators have been developed, differentiating among economic, environmental and social categories. Using existing indicators is key. In this respect there are already quite good examples from primary sector indicators (biomass production, management), as well as existing indicators about the sustainability of production systems (e.g., biochemicals and biopolymers).
 8. Key financial instruments for biochemicals support (in general for bioeconomy) are available in already established mechanism, such as the Smart Specialisation Strategies and current programs for the support of innovations, Start-ups and SME's. Several examples were presented and can be further revised in Deliverable 4.3 of POWER4BIO.
 9. A list of relevant EU policies and specific national examples that support the development of biochemicals sector has been presented, with the Green Deal and circularity focus as main drivers. At regional level key current driver is the new programmatic period 2021 -2027.

4.2 Food and Feed

In a set of eight training modules, experts from the POWER4BIO consortium gave insights in the current status of food and feed at EU level, novel food innovative practices and factors determining success in business cases, value chains, sustainability, funding opportunities and supporting policies. A wide range of practical examples was presented, and drivers and hurdles for valorisation of biomass for food and feed purposes were explained. Such valorisation on one hand contributes to fulfilling increasing demand for food and feed, and on the other hand may contribute to added value creation from e.g., side streams. Smart solutions will be necessary to satisfy the demands for more sustainable food, feed and non-food applications.



Participants were representatives from industry, including SMEs, industry associations and clusters, governments, R&D community, NGOs and banking sector.

From a business perspective, developing and establishing new processes and products poses both opportunities (e.g., reduction of waste and environmental impact, cheaper sourcing, side stream valorisation, creation of new jobs and income opportunities, reaching (governmental) sustainability ambitions) as well as challenges (safety regulations, legislation for new food products, often number of markets expands when applying biorefinery and consequently the knowledge required). Relevant aspects of different nature related to new food and feed solutions were addressed in more detail in the subsequent 8 training sessions.

Even when bioeconomy has certain advantages at regional level, bioeconomy remains a global or at least a European field of play. Entrepreneurship in the field requires an overview of the general drivers, opportunities and challenges in the food and feed sector in relation to the transition towards a bioeconomy (session 1).

When starting from scratch, examples from elsewhere may be inspiring. As drivers for developments in the food and feed sector are very diverse (added value generation, sustainability ambitions, new trends, regional initiatives), relevant examples are of interest as well (sessions 2 – 5).

There are many diverse aspects affecting the development and establishment of new and high potential food and feed value chains. This diversity of issues makes it very challenging to move from laboratory scale to commercial scale. An overview (summary) of critical success factors as well as hurdles perceived in practice and challenges was given in session 6.

Regional governments or bodies but also commercial financing bodies and venture capitalists may wish to support entrepreneurs and stakeholders to make steps towards a sustainable bioeconomy, but how to start? Information about how to finance food and feed value chains using e.g., European Structural and Investment Funds is relevant in this context (session 7). Also, successful existing supporting policies for food and feed solutions can be inspiring and act as a basis for own policies (session 8).

The main objective of the training series was to provide an introduction to biomass valorisation for food and feed in the global picture (session 1), a number of inspiring examples connected to specific drivers (added value generation (session 2); sustainability ambitions (session 3); trends in food (session 4), regional initiatives (session 5), learnings for high potential value chains (session 6), information about how to finance food and feed value chains using European Structural and Investment Funds (session 7), and supporting policies for food and feed solutions (session 8).

The content of sessions 1 – 6 was prepared by Wageningen Research (WR), based on their background knowledge and further input of project partners. In particular, the region partners have expressed which topics had their main interest. Further, sessions 2 – 4 have taken advantage of bioeconomy solutions addressed in POWER4BIO Deliverables 3.3, 3.4 and 4.1. Session 7 was prepared by META based on their knowledge and Deliverables 4.3 and 4.4. Session 8 was prepared by WR based on the outcomes of Deliverable 4.2 and own expertise.

Eight presentations were given, divided over 3 days, October 28th, November 4th and 11th 2020. The content of the presentations was as follows:

- Introduction to biomass valorisation for food and feed in the global picture: This session introduced the context, drivers and characteristics of (circular) valorisation of biomass (side-) streams for food and feed. Drivers, opportunities as well as drawbacks and threats from an agro-food-biomass



perspective were related to the current EU policy agenda. The presentation is concluded with some principles for circular use of biomass (side-) streams for production of food and feed.

- Technical examples on added value generation: A broad set of examples on valorisation of food processing side streams, extractions of valuable compounds from biomasses and new biomass production routes were presented, driven by needs and opportunities within the agro-food system. Generally, these examples were oriented on cost price reduction (cheap sourcing from biomass side streams, waste reduction) and/or new markets. The examples had varying levels of technology readiness. An aspect which should not be forgotten is that if e.g., proteins (or any other food compound) is extracted from new sources, EU safety (EFSA) clearance may take about 5 years. Take home messages including success factors completed the presentation.
- Examples connected to sustainability ambitions, upcycling and complete biomass valorisation: The presentation focussed on various examples of solutions for which sustainability ambitions are strong drivers for development; some of these are successfully implemented in practice. Concluding success factors and challenges completed the session.
- Examples connected to trends in food: In this session, examples were shown that fill in demands connected to food trends, including: Clean label, healthy ingredients, reduction of food waste and recycling of surplus food, alternative and plant-based protein sources. One of the take home messages was that new processes, market and market volumes need to be co-developed.
- Technical examples of regional initiatives: Various initiatives are driven by specific regional conditions; through a number of examples, it was shown how such opportunities are utilized. Examples range from small scale (conventional mixed farming), via medium scale (agro-complex) to large scale regional initiatives (agro-processing cluster). Technological, socio, economic and environmental opportunities were elaborated. Overall, a regional approach allows multiple synergies in the fields of e.g.: use of residual streams, energy and water use, R&D, logistics, advise, facilities, and surprisingly even economy of scale.
- Learnings for high potential value chains: Based on practical examples and their relationship with external drivers and hurdles presented in the foregoing webinar sessions, learnings for developing new value chains were presented. Focus was on added value generation (converting waste into feed or even food), sustainability, trends in food and regional opportunities.
- How to finance food and feed value chains using European Structural and Investment Funds: The importance of financial support to boost the emergence of bioeconomy solutions is underpinned. The design and access to funding schemes to set up financial products for food and feed enterprises were envisaged. Practical aspects to implement financial Instruments were taken into account, and relevant best practices, lessons learned in the fields of loan, guarantee and equity instruments were presented. In conclusion: Many examples, tips, quantification and references to further info.
- Supporting policies for bioeconomy – focus on food and feed: The needs, limitations and opportunities of policy instruments for the food and feed sector were tackled. A closer look was taken to policy instruments that facilitate and set requirements to the development of potential value chains. Also, good examples of existing policy instruments that regulate and support bio-based business models at regional level were presented, as well as announced policies and regulations.

The main outcomes of the sessions were:

- 1) Leading principles for circular development include:
 - a. Try to make best use of the biomass' value: Prevent loss of function (e.g., keep protein in native state); Choose applications in which nutrients (proteins!) keep their value; Eliminate intermediate steps that do not add nutritional value.



- b. When only a small fraction of the biomass is functional/valuable in an application, separation may be wise.
 - c. Prevent hurdles (intermediate steps) for next cyclic use, thus increasing the number of uses per unit virgin material.
- 2) Success factors derived from technical examples on added value generation:
- a. Focus on added value creation: Converting 'waste' into energy carriers, chemicals, materials, feed, and even food.
 - b. Find inspiring examples.
 - c. Success conditions:
 - i. Existing logistics for gathering biomass
 - ii. Existing processing facilities for similar products
 - iii. Existing channels for product sales; market size fits residue size
 - iv. Enthusiast entrepreneur
 - v. Ability to take a loss in the start-up phase (investor, large company, shared facilities)
- 3) Success factors derived from examples connected to sustainability ambitions, upcycling and complete biomass valorisation include:
- a. Total valorisation leads to more efficient use of biomass
 - b. Circular systems are relevant for sustainability
 - c. Value creation is a solid driver
 - d. High value examples: protein, functional biopolymers, food additives (webinar 4)

The main challenges included:

- e. Total valorisation involves diversity of products, and thus markets
 - f. New products need legislation development (food)
 - g. Subsidy should provide learning curve
- 4) Developing new products needs to go hand in hand with developing the market and market volume.
- 5) Various initiatives are driven by specific regional conditions. A regional approach allows multiple synergies in the fields of e.g.: use of residual streams, energy and water use, R&D, logistics, advise, facilities, and surprisingly even economy of scale. Regional solutions may be small scale (conventional mixed farming), medium scale (agro-complex) or even large scale (agro-processing cluster).
- 6) Development of high potential value chains involves:
- a. An answer to external drivers and hurdles (e.g., circularity, reduce cost and environmental impact, legislation)
 - b. Added value generation (converting waste into feed or even food, e.g., proteins and functional compounds)
 - c. Considering challenges (e.g., diversity of products and thus markets)
 - d. Considering regional synergies (see session 5)
- 7) Financial support is key to create new jobs in general. As consequence also to boost the emergence of bioeconomy solutions. Many examples, quantification and tips are given, as well as references to further info.



- 8) To establish regional policy, EU bioeconomy and circularity strategies provide solid guidance as well as policy integration (EU - National – regional) needs. For example, the Green Deal and the Farm to Fork strategy (agenda for new proposals, strategies, regulations, code of conducts, etc.). A list of important EU level policies relevant for regional level were presented.

4.3 Bioenergy

Using biomass resources for fuels and power is widely recognized as a critical component in the bioeconomy strategies to reduce greenhouse gas emissions and address our continued dependence on imported oil. Dependence on imported oil exposes the countries to critical disruptions in fuel supply, creates economic and social uncertainties for business and individuals and impacts national security.

In this context, this training was focused on key aspects for promoting and evaluating the technical and non-technical solutions and also the barriers for valorising the biomass in the industrial rural environment identifying needs still to develop for the implementation of bioenergy projects.

For this purpose, seven thematic training modules were developed with the aim to summary the technological, normative and financing state of art for the bioenergy production addressing questions about how to measure and understand their impacts at regional level. Also, the resource and energy efficiency for traditional technologies in rural areas was addressed. Therefore, this training looked for identifying knowledge gaps and implementation challenges concerning production technologies, normative and financing instruments tackling the uncertainties that farmers face for valorising the residual biomass and proposing some recommendations.

This webinar was attended by representatives from universities, industry, technological centres and other European institutions working in the bioeconomy field.

Seven presentations were given, divided over 3 days, December 11th, 15th and 17th 2020. The content of the presentations was as follows:

- Biogas from agro-residues: farm waste as a resource for bioenergy production: This session presented a general vision of anaerobic digestion technology for valorisation of biomass in rural areas. Information on current traditional and innovative technologies at small scale focused on industrial examples on production of biogas and information related to business cases was exposed.
- Sustainable and economic rural heating with agro-biomass: challenges, technologies and success cases. A broad set of examples on valorisation of agro-biomass across Europe were exposed. The examples included information concerning the entire value chain, from sources to products. A broad summary of initiatives exposing the most relevant aspects in the valorisation of agro-biomass was presented.
- Viñedos por calor: A particular project developed in a wine area served as example of the potential of valorisation of the grape residues for bioenergy production. The most relevant factors and challenges when it comes to set up an initiative like this were explained.
- Roadmaps from promotion to implementation of small and medium size bioenergy projects in rural Romania: In this session, many examples located in Romania were presented. The technical steps and the non-technical barriers needed to scale-up processes were explained.
- How to finance bioenergy companies and its value chain using ESIF. The ingenium ESIF fund: a tool to foster regional economic development: In this session, the most relevant financial Instruments addressed to implement bioenergy projects were exposed. Some examples served to present the advantages from ones and others.



- The European Green Deal: Bioenergy perspectives: This session reviewed the state of the art of the Green Deal European call, focusing on bioenergy topics. Financing and technical elements were the focus of the presentation.
- Supporting policies for bioeconomy – focus on Bioenergy. The policy instruments that facilitate the implementation of bioenergy projects were exposed and regulation and supporting bio-based business models at regional level were presented.

The main outcomes of the sessions were:

1. Bioenergy production suppose an easy-to-use application for valorisation of biomass with previous experience in the agro-industrial sector.
2. Sinergies of collaboration between rural actors are viable and essential for the launch of a new bioenergy initiatives.
3. Bioenergy production present better conditions than others bio-applications in terms of proximity to the market and more effective results.

The main challenges included:

1. Imbalance between volume of waste and energy demand for small-medium agro industries.
2. Lack of a single financing-legislative framework to support regional initiatives for bioenergy production.
3. Lack of continuous support to increase the competitiveness of bioenergy production solutions with respect to conventional energy carriers.
4. Time and availability to adapt conventional energy production technologies at small scale in rural areas.

4.4 Biomaterials

Shifting from non-renewable resources to bio-based materials is an important innovation aspect of the circular economy agenda. The bioeconomy and the circular economy are thus conceptually linked and therefore most recent EU policy ambitions and guidance comes from both the Green Deal and the recently published Circular Economy Action Plan.

Scaling up bio-based value circles is an important objective of the circular bioeconomy. Substituting fossil-based value chains to bio-based ones will make our life healthier and more sustainable. Using agricultural side-streams to create new materials is welcomed by the policymakers and the consumers. Bio-based materials can be used as raw materials to produce bio-based final products, such as bio-based fibres, bio-based foam for packaging applications, hemp-based insulation material for buildings, plant-based "leather-like" material for clothes, furniture, packaging, automotive applications etc. The European Environmental Agency already advises that bio-based, biodegradable materials alternative to plastics should be used where the risk of dispersion into the ecosystem is high, such as lubricants, materials subject to wear and tear, and disposable products.

Transition from fossil-based to bio-based economies is demanded. The POWER4BIO webinar focused on the support of this transition, via presenting policy and financial aspects and good practices. Results of this transition were also shown by inviting companies to present their solutions and by presenting projects supported by BBI JU.

As a result of these sessions, the regions will take a closer look at its existing projects to analyse and identify new technological and research needs. The attendants could use this information report as inspiration to inform and promote discussions on new activities at national and regional level and to require additional input from stakeholders.



Although there are several good practices can be found in EU level in the field of bio-based materials, it is always worth mentioning the existing supporting mechanisms available. That is why the webinar focused on different aspects:

- How can policies support the transitions from traditional economies to bio-based economies?
- Are there financial instruments supporting this transition?
- How can POWER4BIO project help for the bioeconomy stakeholders?
- Are there good practices financed by public sources, such as by BBI JU funds?

It was also the motivation of the organisers to show good, working practices. That is why different companies were invited to present their products, services, their vision or maybe their obstacles. Four companies accepted the invitation. The solutions presented were diverse: from packaging to construction industry, from Belgium to Croatia.

POWER4BIO training webinar series on bio-based materials was organised on 19 and 22 January 2021. The main objective of the training series was to introduce biomaterials (general POWER4BIO presentation, presentation of toolkit developed during within the project (BSAT) and an overview of projects supported by BBI JU) (Day 1) as well as to provide an overview of the financial instruments and supporting policies (Day 2). Both days gave opportunity to present good practice cases of companies working in the field of bio-based materials.

Total of nine presentations were held to inform the participants about the current status of bio-based materials at EU level, innovative practices and keys for successful business cases, value chains, sustainability, funding opportunities and supporting policies. Organisers aimed to present the diversity of the world of biomaterials: company presentations allowed the attendees to get familiar with inspiring products and the vision of the companies. It was the objective of the webinars to present some important aspects and results of the POWER4BIO project as well. All webinars were free of charge and open to everyone.

Participants of the webinars represented different sectors, such as academia, industry, including SMEs, industry associations and clusters and governmental organisations.

The webinar was hosted and organised by Bay Zoltan Nonprofit Ltd. for Applied Research, the beneficiary of POWER4BIO project. Company presentations were given by the representatives of Orieno, Bio-Mi, Mogu S.l.r. and EXIE - Experts in Healthy Houses. Other presentations were given by POWER4BIO beneficiaries (Bay Zoltan Nonprofit Ltd., CIRCE, META Group and Wageningen Food & Biobased Research). Presentations of POWER4BIO partners were based on the project deliverables D2.4., D4.2., D4.3. and D4.4. BBI JU projects were selected by the presenter.

Nine presentations were given. The content of the presentations was as follows:

- Introduction to the POWER4BIO project: its concept, activities and outputs, with a special highlight to its regional approach. Presentation of the Hungarian Bioeconomy Cluster, which is also a result of POWER4BIO project, as being organised as the Regional Bioeconomy Hub in Hungary.
- The BSAT - Bioregional Strategy Accelerator Toolkit was presented by Ignacio Martin, coordinator of POWER4BIO project, representing CIRCE Foundation. It is one of the main outcomes of the project, which aimed to provide information mainly for representative of the regions, however it collects useful tools and information for other stakeholders as well. It was shown that this tool will support both the creation of regional bioeconomy strategies, as well as updating the existing ones. The different phases of strategy development and strategy update can be found in the tool, with background and supporting documents and practical examples. Although it does not collect the available bioeconomy strategies, Javier Sanchez Lopez (JRC-ISPRA) recommended a website for this purpose: https://knowledge4policy.ec.europa.eu/visualisation/bioeconomy-different-countries_en



- “Introduction to biomass valorisation for biomaterials” session gave an overview of the Bio-based Industries Joint Undertaking (BBI JU) and its main focus areas. 9 BBI JU-funded projects were presented by Kornel Mateffy (Bay Zoltan Nonprofit Ltd.) in the field of bio-based materials. 5 of them focusing on the packaging industry, 2 on the automotive and construction sector, 1 provides solution for the textile industry and 1 is used for different other applications.
- The first company presentation was given by Philippe Willems, founder and director of Orineo, Belgium. Orineo aims to produce products, which are bio-based, harmless and authentic. Two products were presented in detail: Oribond, which is an all-natural binder platform, and Touch of Nature® aesthetic material. Both products are available throughout Europe, and both supports the mission of the company: developing new-to-the-world bio-based materials. The products and processes of Orineo supports several of the Sustainable Development Goals of the United Nation, as well as the Green Deal priorities of the European Commission. Mr. Willems highlighted that production of bio-based materials is not only a manufacturing process, but also a mission.
- Luigi Amati (META Group) presented the main outcomes of D4.3. and D4.4. of the POWER4BIO project, with the title: “How to finance biomaterials and their value chains using European Structural and Investment Funds”. He explained the function and aims of European Structural and Investment Fund (ESIF), its operation and its financial instruments, such as loans, guarantee, equity and quasi-equity. He gave a thorough overview about how to finance SMEs and start-ups via ESIF funds. Regional examples were presented, as well as a case study example, GreenBone, which is a high grow high risk company, which could benefit from the different kinds of financial instruments.
- Berien Elbersen from Wageningen Food & Biobased Research gave a general overview of bio-based economy (BBE) and policy instruments. Then, she focused on the EU policy instruments supporting biomaterial sector and link to national and regional policy implementation. The main focus of her presentations was the update of the EU Bioeconomy Strategy, the EU Green Deal and the Circular Economy Action Plan, and she thoroughly explained how the bio-based materials can be found in these policy instruments. Two good policy instruments were shown, an Italian and a German one. The presentation was closed with a conclusion and recommendation part.
- A Croatian company, Bio-Mi was presented by its CEO, Filip Miketa. The presentation started with a general company presentation, then highlighted the biomaterials-related research and development activities and projects. Their products are on 4-9 Technology Readiness Level (TRL), from monomers/oligomers and biopolymers to final materials, products and solutions. Their main products are different bioplastics, and the company’s role in the value chain was shown. As the webinar focused on well-functioning good practices, market activities were an important part of the presentation.
- The row of company presentations was continued with an Italian company, Mogu S.r.l., which was introduced by its Head of Innovation, Gianluca Belotti. Mogu’s mission is well-embedded in the circular bioeconomy concept, as they create high-added value product from a low-value input matter, using fungal mycelium. The difficulties of a start-up company were presented, as well as several hands-on advices how to overcome by these difficulties. Mogu’s products, such as the acoustic panel, floor and mycelium leather was presented in detail, showing the diversity of bio-based materials to the audience.
- Biomaterial success stories were closed with the presentation of Jan Palmaers from EXIE - Experts in Healthy Houses. The Belgian company produces insulation material made of hemp. Sustainability is a key aspect for the company, that is why they sell not only the product, but the technique as well, allowing the use of local hemp, which can be cultivated easily under different climate circumstances. He explained the advantages of the technique and the material. Social responsibility is also important



of the company, their technique is used under special circumstances, e.g., for mobile buildings after an earthquake.

The main outcomes of the sessions were:

- 1) POWER4BIO project produced valuable results. They can be found on the project website: <https://power4bio.eu/>
- 2) BSAT is an essence of the POWER4BIO results. It collects many results of the project. Each stakeholder group can find materials which might be useful for them. It will be accessible from February 2021.
- 3) BBI JU provides funding to realize bioeconomy-related projects. Although the competition is high, it is worth trying, as it can boost the project and/or service development.
- 4) Success factors of the company presented (Orineo):
 - a. Believe in having impact, even for a small company.
 - b. Believe in your mission.
 - c. Possible impact for a company producing bio-based materials:
 - i. preserving nature;
 - ii. ethical and emotional communication of the bio-based product can complement the rational communication;
 - iii. products enhance the quality of life.
 - d. Cost-effectiveness cannot be the main motivation for substituting formerly used materials, as in most of the cases fossil-based materials are cheaper. However, the bio-based technique can be cheaper than several other techniques. There are companies which are ready to pay more for products which have environmental and health benefits.
- 5) Financial support is key to create new jobs in general. Messages of the presenter were the following:
 - a. Equity is the most suitable financial instrument for knowledge intensive companies.
 - b. Co-investment facility (i.e., fund + services, such as advice) creates more impact. It may include grants as well.
 - c. Deal by deal approach is important for reaching the contribution of the private sector.
 - d. When setting up a regional fund, a commercially driven fund manager is a must.
 - e. Co-investment instruments attract more private sector actors.
- 6) EU and national policies can provide a guidance when preparing regional policies. Regions that have the ambition to transform their economy towards a bio-based and circular economy need to develop regional strategies and road maps. Further recommendations can be found in the POWER4BIO policy overview document: <https://doi.org/10.18174/524319>
- 7) Success factors of the company presented (Bio-Mi):
 - a. Find your proper place in the value chain.
 - b. Use the opportunities available for research activities.
 - c. Certification is important.
 - d. Plan further.
- 8) Recommendations from Mogu S.r.l.:
 - a. Your innovative material should be really sustainable and economically competitive.
 - b. Your material should be produced at scale.
 - c. Deep understand the needs of your costumers is a must.
 - d. Understand how the supply chain works.
 - e. Understand your costumer's journey.
- 9) Success factors of the company presented (EXIE - Experts in Healthy Houses):



- a. Point your Core Values, such as Zero Carbon/ Recycling/ Natural products/ Local production/ Sustainability/ Healthy environment.
- b. Certifications matter.



5 CONCLUSIONS AND RECOMMENDATIONS

Training, as part of the knowledge transfer activity, plays an important role in driving the structural change toward a more sustainable production and consumption. Currently, sustainability and circular bioeconomy are not sufficiently addressed by traditional educational programmes, so a higher number of training initiatives in bioeconomy should be promoted.

In this task, different training materials were developed for a wide range of professionals and sectors, sharing learnings and knowledge, and transferring good practices. The structure of content and the methodology followed were designed thinking in the final use of the material by the participants.

The number of sessions carried out were 33. The average of people registered in the courses was around 110 for each webinar from 42 countries in total.

Different conclusions and lesson learnt have been summarized from the information exposed in the trainings and the feedback collected from the assistants to the sessions.

- Competences and skills are needed to exploit the opportunities offered by the bioeconomy that are still under-explored.
- There is a poor connection among the sector-specific labour market needs and future demand along the entire value chain.
- Training programmes must address potential beneficiaries, like primary producers, suppliers, entrepreneurs, start-ups, and policy makers.
- The opportunities offered by the bioeconomy should be disseminated and exposed by means of training programmes always taking into account the needs, language and time availability.

Moreover, based on the experience of this task, some general recommendations can be suggested in order to improve future training initiatives in the field of the bioeconomy.

- New formats for the bioeconomy trainings should be explored to better respond to the different emerging needs, exploiting the good practices implemented by different projects and initiatives.
- Training needs should be designed and implemented at regional level, to better adapt the focus on the specific regional resources and conditions; nevertheless, an integrated vision of the training framework should be designed centrally (for example at European level) and deployed locally (even with the support of dedicated projects supporting the regions in this process).
- The knowledge sharing and collaboration among different training programmes, projects and initiatives, could be the base to stimulate the debate about training in bioeconomy better responding to the bioeconomy evolutions.
- Bioeconomy training initiatives should include the evolution of the bioeconomy labour market, the identification of new skills and competences and needs of all bioeconomy sectors, mainly primary production and industry, as main topics of their content. The target audience should include feedstocks providers, policy makers, intermediaries, entrepreneurs and education providers.

Lastly, all training materials composed by multimedia presentations and summaries will be stored and integrated in the POWER4BIO webpage and the BSAT.



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