

## BIO-BASED STRATEGIES AND ROADMAPS FOR ENHANCED RURAL AND REGIONAL DEVELOPMENT IN THE EU

<sup>1</sup>Felix Colmorgen, <sup>1</sup>Cosette Khawaja, <sup>1</sup>Dominik Rutz,  
<sup>2</sup>Holger Gerdes, <sup>2</sup>Zoritzza Kiresiewa, <sup>2</sup>Gerardo Anzaldúa, <sup>2</sup>John Tarpey, <sup>2</sup>Jenny Tröltzsch, <sup>3</sup>Sara Davies, <sup>3</sup>Stefan Kah, <sup>3</sup>Elsa  
João, <sup>3</sup>Neli Georgieva, <sup>4</sup>Boris Mannhardt, <sup>4</sup>Ines Herlitze, <sup>4</sup>Clément Robijns, <sup>5</sup>Martin Stoyanov, <sup>5</sup>Ludmila Metzova, <sup>5</sup>Iliana  
Pavlova, <sup>6</sup>Emilija Mihajloska, <sup>6</sup>Vladimir Gjorgievski, <sup>6</sup>Natasa Markovska, <sup>6</sup>Neven Duic, <sup>7</sup>Carmen Pauna, <sup>7</sup>Raluca Iorgulescu,  
<sup>7</sup>Tiberiu Diaconescu, <sup>7</sup>Daniel Cosnita, <sup>7</sup>Mihaela Simonescu, <sup>8</sup>Dagnija Lazdina, <sup>8</sup>Kristaps Makovskis, <sup>8</sup>Santa Neimane,  
<sup>9</sup>Marcin Rakowski, <sup>9</sup>Olga Szulecka, <sup>9</sup>Adam Mytlewski, <sup>9</sup>Dorota Skrzynska  
<sup>1</sup>WIP – Renewable Energies, Sylvensteinstr. 2, 81369 Munich, Germany  
Tel. +49 89 720 12732, Fax +49 89 720 12791  
E-Mail: [felix.colmorgen@wip-munich.de](mailto:felix.colmorgen@wip-munich.de); [cosette.khawaja@wip-munich.de](mailto:cosette.khawaja@wip-munich.de)

Internet: [www.wip-munich.de](http://www.wip-munich.de), [www.be-rural.eu](http://www.be-rural.eu)

<sup>2</sup>Ecologic Institute, Germany, <sup>3</sup>University of Strathclyde, Scotland, UK, <sup>4</sup>BIOCOM AG, Germany, <sup>5</sup>Bulgarian Industrial  
Association, Bulgaria, <sup>6</sup>International Centre for Sustainable Development of Energy, Water and Environment Systems -  
Macedonian Section, North Macedonia, <sup>7</sup>Institute for Economic Forecasting - Romanian Academy, Romania, <sup>8</sup>Latvian State  
Forest Research Institute "Silava", Latvia, <sup>9</sup>National Marine Fisheries Research Institute, Poland

**ABSTRACT:** The BE-Rural project supports the establishment of regional and local bio-based economies by involving relevant actors in the development of bioeconomy strategies and roadmaps. The target regions of BE-Rural are in Eastern and Southeastern Europe: Stara Zagora (Bulgaria), Szczecin Lagoon and Vistula Lagoon (Poland), Strumica (North Macedonia), Covasna (Romania) as well as Vidzeme and Kurzeme (Latvia). The characteristics of the selected regions are analysed, best practices identified, and suitable business models defined. This analysis will help to assess the 'bioeconomy potential' of each selected region. Based on that, a series of regional Open Innovation Platforms will be implemented to kick-start the co-creation process, bringing together key stakeholders from academia, policy, business, and civil society to develop ideas and capitalize on their bioeconomy potential. These activities include research & innovation capacity building workshops, educational seminars and webinars, summer schools and bio-based Pop-up stores. A knowledge network will be established to share knowledge, lessons learned and best practices from the Open Innovation Platforms at an inter-regional level, to close the information gap on issues related to sustainability and to increase capacities of regional authorities and stakeholders.

**Keywords:** bioeconomy, regional policy, co-creation, sustainability, business models, inclusiveness, bio-based value chains, stakeholder involvement

### 1 INTRODUCTION

Limitations of natural resources, climate change, world population growth, and loss of biodiversity are among the main global challenges today. The switch of current economic systems to bioeconomies can maintain the long-term prosperity of modern societies by enabling economic growth in accordance with protecting nature and the environment. The basis of the present European and national bio-based strategies was formed in 2012 through the strategy "Innovating for Sustainable Growth: A Bioeconomy for Europe" of the European Commission [1]. Therein the bioeconomy is defined as "the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy. Its sectors and industries have strong innovation potential due to their use of a wide range of sciences, enabling and industrial technologies, along with local and tacit knowledge." The bioeconomy is currently generating a turnover of € 2.3 trillion, as such it can already be considered as an important pillar in the EU economy [2].

One of the major strengths of the bioeconomy concept is the development and support of rural, coastal and remote areas by adding values to commodities which are produced by the agricultural, forestry, fishery or waste sectors. This could reduce the rural exodus through job creation and improve territorial cohesion through social innovation. The bioeconomy could especially support SMEs from different sectors. Therefore, underused, or even unused potentials and resources need

to be identified, analysed, and valorised. Thereby, the local context must be considered, and concepts developed which can stimulate new businesses at different scales. The overall goal is a more proportionate and fair sharing of the benefits of a competitive and sustainable bioeconomy across regions, countries, and whole Europe. In order to benefit from a European bioeconomy, national and local bio-economy strategies need to be developed and implemented, which is not yet the case in numerous European countries, especially in Eastern Europe.

### 2 THE BE-RURAL PROJECT

The overall goal of BE-Rural is to realise the potential of regional and local bio-based economies by supporting relevant actors in the participatory development of bioeconomy strategies and roadmaps. Specifically, the project has the following objectives:

1. To support modest and moderate innovator countries in the development of regional bioeconomy strategies and roadmaps.
2. To increase awareness, education and understanding of the bioeconomy, its potentials and impacts among regional actors by considering stakeholders' and citizens' needs and concerns.
3. To mobilize engagement among regional stakeholders and citizens in view of the development of inclusive and balanced bioeconomy strategies and roadmaps.
4. To build capacity among regional stakeholders

regarding the assessment of innovative bio-based business models and their potential impacts, the fostering of R&I capacities, the design of a supportive policy framework, and effective utilization of available funding streams.

5. To explore small-scale business models and their market potentials suitable for realising bio-based innovations across different bioeconomy sectors.
6. To identify and disseminate good practices and facilitate knowledge sharing across European regions.
7. To generate new knowledge on the effective development of regional bioeconomy strategies and roadmaps and to make that knowledge available for uptake in policy processes in other regions across Europe.

To meet these objectives, BE-Rural builds on co-creation, openness and inclusiveness and sustainability, which are all reflected in the project's conceptual approach and work plan.

In the first phase of the project, the focus lies on the generation of knowledge and initial research related to regional bio-based economic strategies. Meanwhile, local regional partners focus on solidifying and expanding their regional bioeconomy networks, identifying and reaching out to additional groups and interest organisations. These activities are supported through BE-Rural's Stakeholder Working Groups (SWGs), which have been set up at the beginning of the project.

The second phase focuses on the transfer of knowledge and capacity building through co-creation spaces. To facilitate this co-creation process, BE-Rural created five regional Open Innovation Platforms (OIPs) (see section 3) for the participatory development of bioeconomy strategies and roadmaps.

The third phase sees the five OIPs become the foundation for a 'Network of Knowledge' which will facilitate the wider sharing of good practices and lessons learned among the OIPs and with other European regions. The fourth phase focuses on the dissemination and exploitation of project results. Outcomes of the project will impact various key stakeholder groups in and outside the OIP regions.

The conceptual foundation of BE-Rural builds on a Quintuple Helix Approach, which combines knowledge and innovation generated by key stakeholders from policy, business, academia and civil society within the frame of the environment (Figure 1) [3].

This approach embeds previous approaches of the Triple Helix and Quadruple Helix. The prior focuses on knowledge creation, production, application, diffusion and use generated from the interaction between academia, industry and the government. The Quadruple Helix takes this one step further and frames the Triple Helix within the context of the public (i.e. "media-based and culture-based public") so that knowledge production, application, diffusion and use take into consideration social acceptance and uptake. Building on these developments, the Quintuple Helix Approach then embeds the consideration of the natural environment into these knowledge-generation and innovation processes. In other words, the environment acts as a "driver for the creation of new knowledge and innovation in response to the environmental challenges" [3].



**Figure 1:** Quintuple Helix Approach [3]

### 3 OPEN INNOVATION PLATFORMS

The regional project activities are supported by BE-Rural's SWGs in each local region. Key stakeholders, including local municipalities, relevant cluster organisations, and economic development agencies have expressed their willingness to support the project by taking on active roles in the establishment of the regional SWGs, which represent a broad spectrum of stakeholders. In each of the local regions, Open Innovation Platforms (OIPs) are created in order to facilitate the co-creation process and thus the participatory development of bioeconomy strategies and roadmaps. The latter do not only depend on the stakeholders but also on e.g. (biomass) resources or economic priorities that differ between the local regions addressed.

#### 3.1 Stara Zagora (Bulgaria)

The OIP focuses on seeking new technologies for the application of essential oils and herbal plants in the cosmetics and pharmaceutical industry. The small-scale production in this area will be combined with tourism-related activities to expand the existing business status quo and potential. Ultimately, the OIP will establish closer relations and network between companies.

#### 3.2 Szczecin Lagoon and Vistula Lagoon (Poland)

The OIP focuses on small-scale fisheries, specifically on the sustainable use of currently underused and low-value fish species located in two lagoons. The OIP will investigate small-scale technology options that can be applied to utilize low-value fish species as products for human consumption.

#### 3.3 Strumica (North Macedonia)

The OIP focuses on the utilization of agricultural residues, specifically the by-production of organic materials from agricultural activities, as a source of energy for domestic and industrial purposes. The OIP will investigate technology options for energy conversion of biomass materials generated on agricultural fields or farms (field-based residues), as well as those generated during the processing of agricultural products (process-based residues).

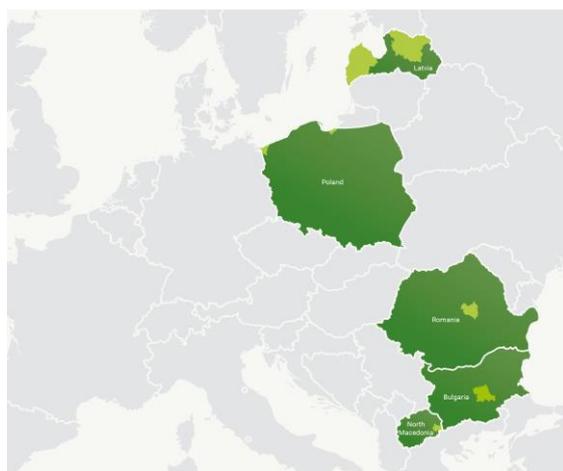
#### 3.4 Covasna (Romania)

The OIP focuses on addressing fragmented value

chains and implementing the circular economy concept within the county's industrial sectors (i.e. wood and furniture, textiles, agro-food, mechanical engineering, green energy). The OIP will investigate the development potential of underused biomass (plant matter and wood waste) and its implication on societal challenges (e.g., rural unemployment or marginalised communities). This will be done within a local development business model of "1 village 1 MW" based on a small-scale technology option ensuring the autonomous energy supply for civil and industrial needs.

### 3.5 Vidzeme and Kurzeme (Latvia)

The OIP focuses on the potential of young trees - by-products of forest management (i.e. from young forest stand thinning), short rotation coppice and forestry (SRC/SRF) plantations, removed overgrowth from abandoned agricultural lands and agroforestry systems of fast growing trees with perennial grasses as a source for bioenergy or biorefinery. The OIP investigates the value of agroforestry systems of perennial grasses and SRC or SRF trees as grazing areas, and the production of hay or grass seeds. The potential smart use of small timber wood from young forest stand thinning will be explored.



**Figure 2:** BE-Rural's Open Innovation Platforms: Stara Zagora (Bulgaria), Szczecin Lagoon and Vistula Lagoon (Poland), Strumica (North Macedonia), Covasna (Romania), Vidzeme and Kurzeme (Latvia)

## 4 PROJECT RESULTS

The BE-Rural project is running since April 2019 and the first results are already available. This chapter summarises the most important outputs reached so far. These relate mainly to the knowledge gathering and initial research conducted in the first project phase, which was completed in February 2020.

### 4.1 Small-scale technology options for regional bioeconomies

One of the first outputs of the BE-Rural project is a detailed report on small-scale technology options for regional bioeconomies. This report provides an overview of technology options, which are considered good-practice examples when it comes to facilitating the transition to a regional bio-based economy, looking at the five Open Innovation Platform (OIP) regions covered in

BE-Rural and beyond. Inspired by their bioeconomy potentials, a set of small-scale technology options and good practices was compiled and discussed with representatives from the OIP regions. A selection procedure intended to reduce the pool of different technologies and good practices to a final set of 16, which this report presents in a factsheet format. The factsheets include general background information, technological and economic descriptions, the motivation behind the technology, as well as an outline of the environmental and socioeconomic impacts. Furthermore, advantages and disadvantages of small-scale technology options compared to larger and more complex systems, such as large-scale biorefineries, are discussed.

The overview of technology options presented in this report focusses on small-scale technologies that are considered suitable for the development of regional and rural bioeconomies. A definition of suitable technologies was drawn up taking into account the overall scope of BE-Rural. The feedstocks considered are originating mainly from the agricultural, forestry, fishery, and water sectors. The diversity of this set of technology options reflects the nature of the growing bioeconomy – in the context of BE-Rural's OIP regions and beyond. Since there is no single blueprint for developing and implementing the bioeconomy, this overview aims to inspire stakeholders in the aforementioned sectors.

### 4.2 The macro-environment surrounding BE-Rural's Open Innovation Platforms

In another report, the macro-environment of each of the OIP regions was analysed. So, the current state and dynamics of the macro-environment at each of the OIP regions were observed and documented. This is an important groundwork when it comes to planning and stakeholder involvement activities connected to the development of bioeconomy strategies and roadmaps. Using the PESTEL analysis methodology, political, economic, social, technological, environmental, and legal conditions surrounding and influencing the OIP regions were examined. It turned out that while the policy and regulatory mechanisms that frame and influence the bioeconomy vary across the regions – sometimes being more elaborate, sometimes driven mainly by national or supra-national level initiatives – the relevance of collaboration among the local and regional stakeholders to enable a transition from plan to action emerged almost unanimously from the analyses conducted. Moreover, there is a lack of public awareness and knowledge related to the bioeconomy, its potential and benefits. Thus, it is crucial to ensure a better understanding of the notions behind the bioeconomy in the project's regions to guarantee its impact. This becomes highly relevant when it comes to convince and attract the general public, especially the younger generations. Finally, this analysis has confirmed some expected synergies and revealed new areas where the regional bioeconomies of BE-Rural could complement each other and contribute to the vision of a sustainable EU-wide bioeconomy.

### 4.3 Analysis of the bioeconomy potential of BE-Rural's OIP regions

Here, the bioeconomy potential of BE-Rural's OIP regions were analysed with the Self-Assessment Tool (SAT) launched by the European Commission. The SAT is an online tool composed of two sets of questionnaires which identifies biomass and waste as alternative raw

materials and are based on eight Key Factors: Long term, stability and availability of feedstock; infrastructure to handle feedstocks and production; access to finance; skilled workforce, technical expertise and training; existence of support institutions; strength and availability of regional markets; entrepreneurship; and Public support policies. It became obvious, that BE-Rural's OIP regions have very different situations and conditions. Therefore, their potential for the development of bioeconomy strategies differs significantly. Nevertheless, some general observations can be concluded:

1. All BE-Rural's OIP regions have biomass and waste resources which could in some cases even be used for large-scale applications (e.g. in Covasna, Romania and Vidzeme and Kurzeme, Latvia). In general, the absence of biomass resources in a region is the most limiting factor for the development of a regional bioeconomy. Moreover, the type of feedstock plays an important role for defining the possible applications for and the orientation of the bioeconomy.
2. The lack of awareness about the opportunities that a bio-based economy can offer is a main hindering factor. The BE-Rural project will play a very important role in this respect as it will bring stakeholders together, engage them and inform them about the bioeconomy and the opportunities that bio-based projects can offer.
3. The public policies supporting the bioeconomy on different levels are key elements for the development of the bioeconomy, which are currently less supportive in most of the OIP regions. The BE-Rural project aims at addressing existing policy gaps and will suggest solutions in the regional strategy / roadmap document which will be developed for each OIP region.
4. Even in conditions with available biomass resources, awareness of the bioeconomy and favourable policies, bioeconomies cannot develop if financing is not available or if entrepreneurs and/or investors are not willing to invest in bio-based projects.

#### 4.4 Business models for regional bioeconomies

Another important output of the project was a report which focusses on small-scale businesses that are suitable for rural areas and addresses the business opportunities of BE-Rural's OIP regions (see section 4.2 and 4.3). Four exemplary small-scale businesses were selected and analysed with the business model canvas (a tool for developing and analysing business models) and their suitability for the OIP regions was assessed. It became obvious that the OIP regions have different prerequisites, opportunities and challenges that affect the development of new bioeconomy businesses. In addition to that assessment, the economic, social and environmental impacts of each business were analysed. While the overall analysis demonstrated that the OIP regions cannot just replicate the analysed businesses as they are, the results are of relevance for the development and establishment of future bioeconomy businesses and strategies in the five regional contexts.

#### 4.5 Handbook on regional and local bio-based economies

One of the main outputs from the first project phase is a nicely designed and easy to understand handbook. It

is freely accessible in seven national languages, aiming to overcome the current lack of bioeconomy information in the project's target regions. Therefore, the handbook addresses different target groups, such as decision makers, investors, farmers, foresters, landowners, small bioeconomy industries, scientists and civil society actors that are interested in bioeconomy topics. The handbook provides a comprehensive view on:

1. Basics about the regional bioeconomy (bioeconomy concepts, bioeconomy principles, strengths, challenges, opportunities, limitations, biomass feedstocks and conversion)
2. Options for the use of biomass in a regional bioeconomy (a catalogue of several conversion technologies and pathways, supplemented with concrete and existing technology and business examples)
3. Business models for a regional bioeconomy (comprehensive compilation of several elements and tools and general information on business models that are relevant for developing business models in a regional bioeconomy)
4. Sustainability impacts of the bioeconomy (environmental, social and economic impacts)

The complexity of the bioeconomy is shown, which applies for both, strengths and weaknesses. It shows that the bioeconomy must be understood as a versatile concept that has to be adapted to regional circumstances. It is not possible to impose predefined and fixed technology options or business models on regions without having a comprehensive knowledge on the local prerequisites (political framework, biomass feedstocks, SME landscape, infrastructure and logistics, environmental conditions, financing opportunities, public awareness, etc.). This creates significant challenges, but also opportunities for developing and implementing regionally tailored bioeconomies [4].

## 5 CONCLUSIONS

The work carried out in the first project phase sets the foundation for the implementation of a series of regional Open Innovation Platforms to kick-start the co-creation process, bringing together key stakeholders from academia, policy, business and civil society to develop ideas and capitalise on this bioeconomy potential. Activities include research & innovation capacity building workshops, educational seminars and webinars, summer schools, and bio-based Pop-up stores. Building from this, the proposed 'Network of Knowledge' will aim to share knowledge and lessons learned from the Open Innovation Platforms at an inter-regional level, further disseminating best practices, closing the information gap on issues related to sustainability, and increasing capacities of regional authorities and stakeholders.

## 6 REFERENCES

- [1] European Commission (2012): Innovating for Sustainable Growth. A Bioeconomy for Europe.
- [2] European Commission (2018): A sustainable Bioeconomy for Europe: strengthening the connection between economy, society and the environment. Updated Bioeconomy Strategy. Directorate-General for Research and Innovation,

available at:  
[https://ec.europa.eu/research/bioeconomy/pdf/ec\\_bioeconomy\\_strategy\\_2018.pdf](https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf)

- [3] Abhold K., Gerdes H., Kiresiewa Z., Davies S. (2019): Sustainability and Participation in the Bioeconomy: A Conceptual Framework for BE-Rural. BE-Rural Project, available at: [https://be-rural.eu/wp-content/uploads/2019/09/D1.1\\_Conceptual\\_Framework.pdf](https://be-rural.eu/wp-content/uploads/2019/09/D1.1_Conceptual_Framework.pdf)
- [4] Colmorgen, F., Khawaja, C., Rutz, D. (2020): Handbook on regional and local bio-based economies. BE-Rural Project, available at: [https://be-rural.eu/wp-content/uploads/2020/07/BE-Rural\\_D2.5\\_Handbook.pdf](https://be-rural.eu/wp-content/uploads/2020/07/BE-Rural_D2.5_Handbook.pdf)

## 7 ACKNOWLEDGEMENTS

The authors would like to thank the colleagues of WIP Renewable Energies as well as the BE-Rural partners for their contributions. The authors would like to thank the European Commission for the support of the BE-Rural project. BE-Rural has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818478.

Disclaimer: The sole responsibility for the content of this paper lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein. Reproduction is authorized provided the source is acknowledged.

## 8 LOGO

