

# BIOECONOMY CONCEPT PAPER

EXECUTIVE SUMMARY



## ESTONIA



# EXECUTIVE SUMMARY OF THE STRATEGIC CONCEPT PAPER FOR BIOECONOMY: ESTONIA

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**Endorsement:** The BIOEAST Initiative aims to build knowledge-based agriculture, forestry and aquaculture in the bioeconomy. For this reason, the BIOEASTsUP Horizon 2020 EU project was launched under the auspice of the macro-regional governmental initiative to support eleven countries in building up their own bioeconomy strategies and action plans.



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# Table of contents

<b>Executive summary .....</b>	<b>4</b>
1.1. Context and objectives .....	4
1.2. Challenges and potential of circular bioeconomy development.....	5
1.3. Aims and principles of circular bioeconomy development.....	6
1.4. The main directions for circular bioeconomy development .....	7
<b>2. References.....</b>	<b>10</b>

# Executive summary

## 1.1. Context and objectives

The main goal of this document, the so-called *concept paper*, is to introduce a framework for a national circular bioeconomy strategy document. The BIOEAST Initiative aims to support the development of knowledge-based agriculture, forestry and aquaculture in the bioeconomy. The bioeconomy entails a potential to introduce climate neutral solutions which could become the core part of the new, sustainable economic model. Therefore, the strategic thinking concerning sustainable use of bioresources at a national and regional level should become a priority in terms of ensuring food, energy and industrial security. To support this idea, as presented in the BIOEAST Initiative's Vision, the Horizon 2020 project BIOEASTsUP was launched to support creating the concept for bioeconomy strategies in Central and Eastern European Countries.

The ambitious goals of the European Green Deal (European Commission, 2019) require fundamental changes in business, lifestyle and social norms in general. Bioeconomy is a prerequisite for the green transition and also one of its results (European Commission, 2022). Since the bioeconomy is an interdisciplinary concept that is based on the principles of circular economy (Ministry of Environment, 2022) from the point of view of sustainability, economic development and added value, in **Estonia the term circular bioeconomy is introduced** to highlight the importance of combining these approaches and the possibilities of bioresources to replace fossil materials with more sustainable bio-based alternatives.

**This concept paper reflects the draft of Estonian circular bioeconomy roadmap**, which builds on the national strategic documents and results of the bioeconomy related research projects in Estonia that pave the way for strategic development of circular bioeconomy. The development strategy "Estonia 2035" (Republic of Estonia Government, 2021), stresses the need to promote a sustainable bioeconomy and states an ambition to make Estonia a recognized development centre of the bioeconomy in Europe. Bioeconomy is also a horizontal topic in the "Agriculture and Fisheries Strategy 2030" (Ministry of Rural Affairs, 2021), as well as in the programs that implement it, and several development and action plans (and their drafts) concern the development of the bioeconomy, especially development plan of research and development, innovation and entrepreneurship 2021–2035 and its roadmaps (Ministry of Education and Research, 2021), circular economy white paper (Ministry of Environment, 2022), forestry strategy 2021-2030 (Ministry of Environment, 2023), Energy Sector Development Plan until 2035 (Ministry of Economic Affairs and Communications, 2017) and others. The research project ADDVAL-BIOEAC, conducted in 2018-2021 by consortium of Estonian Universities, mapped the situation, potential and possible development pathways for Estonian bioeconomy (ADDVAL-BIOEC, 2021).

Supported by the BIOEASTsUP project, the activities for the circular bioeconomy roadmap were developed in focus group discussions with representatives of entrepreneurs, R&D, and state institutions.

## 1.2. Challenges and potential of circular bioeconomy development

The main challenges and potentials for the development of the circular bioeconomy in Estonia are as follows:

- In order to **increase the value added** of Estonia's circular bioeconomy, it is necessary to significantly increase valorisation of resources produced in agriculture (especially cereals, raw milk and currently unused biodegradable waste, residues and by-products) both by increasing processing capacity and by introducing new technological solutions (e.g., biotechnological applications). In addition, it is necessary to monitor the development of the livestock sector, which may become affected by changes in consumption preferences and also by the need to limit the GHG emissions. With the potential decline of the livestock sector, grassland biomass will become correspondingly unused, and agricultural land use may change. The provision of biomass must take into account the needs of ensuring biodiversity and functioning of ecosystems, and adaptation to and mitigation of the effects of climate change.
- The **value chain of wood** is currently based on the mechanical processing of wood and is centred around sawmills, wood pellets and heating materials production. Approximately 50% of the handled wood is used for heating. The share of export of paper wood as a raw material is also high, as cellulose and paper are produced in limited quantities in Estonia, and the more modern methods of refining, such as chemical refining are not widespread. However, products that add value to sawmill production, such as wooden factory houses, carpentry and joinery products, furniture and furniture parts are highlighted in current and future exports.
- The development of **fisheries and aquaculture sector** is limited by regulations to preserve natural resources and water ecosystems, and to improve the state of fish stocks. Therefore, it is important to make better use of the existing fish resources. In addition, attention must be paid to the development of cultivation technologies for macroalgae and sea shells and to finding additional possibilities for economic use, which are currently underutilized and which help to remove biogenic substances from the sea and reduce the eutrophication of the Baltic Sea. Sea fish farming has great potential in Estonia, and would enable production of animal protein for food with low environmental impact.
- **Renewable energy** is currently and in the near future related to the use of wood-based biomass, but in order to achieve the best possible efficiency in forestry and energy, it is necessary to pay attention to the industrial exploitation of primary biomass. Without the cascading use of biomass, energy is not a creator of high added value, which is why it is desirable to find new solutions for the industrial processing of biomass, where those by-products and residues unnecessary for industrial use are used for energy. Residues, waste and by-products of biological origin, especially manure from agriculture, would find a more important use in the production of biogas and biomethane, which offer a solution both for the production of local energy (and heat) and help to reduce the agricultural GHG and air pollutants emissions.
- The resulting fermentation residue, or digestate, is a valuable material for circular bioeconomy that has a positive effect on maintaining and increasing the **nutrient and carbon content of the soil**. Enriching the fermentation residue with bio-based and also fossil (e.g., oil shale ash) substances makes it possible to further increase the positive effects on soils. Macroalgae and/or their production residues would be a good alternative to synthetic fer-



tilizers used in agriculture, bringing nutrients from the sea back to the field and thus creating a cycle of nutrients. In the case of synergistic use of the sea area, it is also possible to combine the cultivation of algae and shells with offshore wind farms, i.e., renewable energy.

- An important challenge for the further development of exploitation of Estonia's domestic bioresources is the lack of **comprehensive planning for the circular bioeconomy** at the local community and industry levels, and the lack of cooperation. Low volumes of bioresources and costs for transportation resulting from their dispersion impose limitations on the application of various technologies. In addition, it is necessary to find ways to use potential energy surpluses (e.g., growing vegetables in greenhouses in cooperation with the energy production facilities).
- Increasing the **R&D and innovation capacity** in the furniture industry, chemical industry, wood and paper industry, and addressing these needs in the education system in order to prepare specialists with appropriate training is extremely important. The modest ability of the business sector to spend on R&D activities limits the introduction of new technologies and product development. At different levels of education, not enough attention is paid to the transfer of knowledge about the circular bioeconomy, R&D and innovation. Therefore, there is a lack of specialists who can relate existing bioresources to different processing methods, bioproducts and opportunities in the value chains. Consumer awareness of the environmental impact of their choices and bio-based alternatives with low environmental impact is also low. Bioeconomy related research groups are fragmented, with an uneven level. Cooperation between research groups and entrepreneurs needs improvement.

### 1.3. Aims and principles of circular bioeconomy development

The circular bioeconomy is the foundation of the future economy and an enabler of the green transition, which increases the value added and helps shape Estonia into a leader in the regional circular bioeconomy.

The objectives of the development of the circular bioeconomy are to:

- **reduce dependence on non-renewable and imported resources** with large environmental footprint, ensure self-sufficiency in food and raw materials and food security;
- **increase resource efficiency**, material circulation and the use of by-products and residues as raw materials;
- **strengthen R&D activities** and innovation competence, the development, implementation and adoption of new technologies in society;
- enhance **new initiatives and forms of cooperation** supporting the growth of the value added of the circular bioeconomy (e.g., clusters, cooperative business models, industrial symbiosis, international cooperation, etc.), which also support the export capacity of companies and foreign investments in the circular bioeconomy.

The general principles on which the development of the circular bioeconomy is based are:

- **Sustainability:** avoiding significant damage, a balance between the economy, the social sphere and nature, which also ensures the needs of future generations. All products and services must be based on this principle, the use of biomass must not have a significant negative impact on soils, biodiversity and the ability of ecosystems to recover.
- **Cascading use:** use and processing of the resources by prioritising higher added value – food and feed, bio-based materials and chemicals before using the bioresource to produce energy and fuels.

- **Circularity:** smart, needs-based and as minimal as possible use of the entire resource brought into circulation with the greatest possible societal, social and economic value. The materials are in circulation safely and for as long as possible, the products are long-lasting.
- **Resource security:** food first. Food security is of primary importance, safe and healthy food must be available to everyone. Self-sufficiency with resources is also central in energy and other areas.

The following main groups of actions for the development of the circular bioeconomy were chosen primarily based on the results of the ADDVAL-BIOEC project, roadmaps and action plans related to circular bioeconomy – in particular the green transition roadmap in the agricultural and food sector, research and development, innovation and entrepreneurship roadmaps, circular bioeconomy white paper. Supported by the BIOEASTsUP project, the activities for the circular bioeconomy roadmap were developed in focus group discussions with representatives of entrepreneurs, R&D, and state institutions. In doing so, the focus was on the directions and activities that are based on the aforementioned circular bioeconomy development goals and the approach of the circular bioeconomy as a comprehensive economic model, as well as activities that other existing national strategic development documents do not (sufficiently) address.

## 1.4. The main directions for circular bioeconomy development

The main directions and activities under each direction for the development of the Estonian circular bioeconomy are:

### 1. Greater added value from the circular bioeconomy

1. Development of alternative raw materials (including from the blue economy), innovative and novel foods, and encouraging their introduction.
2. Development and use of alternative and optimized feeds and feed components (based on local plant proteins and processed animal proteins).
3. Development of technological solutions for synthetic biotechnology, cellular agriculture, hydroponics, vertical farming and related ICT solutions.
4. Use of unused or underutilized by-products and residues (including from fisheries and aquaculture) in the chemical, cosmetic and pharmaceutical industry, as well as for the production of fertilizers/soil improvers to substitute synthetic fertilizers and keep nutrients in circulation.
5. Searching for economically valuable genetic or biochemical resources in nature and using them to develop new products (bioprospecting).
6. More efficient organization of handling and valorisation of animal by-products. Finding uses for the ash obtained from burning of animal by-products.
7. Chemical processing of wood (including the use of by-products and residues) and the development of new wood-based products, e.g., the use of cellulose, lignocellulose, hemicellulose and lignin for the production of textiles, biocomposites, packaging, etc.
8. Development of insulation, surface treatment and building materials from wood and other renewable materials.
9. Promotion of the use of wood and other renewable materials in the construction of new facilities and buildings.
10. Development of regional solutions for the collection, logistics and storage of biodegradable waste and related processes, technology and value chains.

11. Further development of biogas plants into biorefineries operating on the principle of cascading use of biomass, which in addition to fuel and energy also produce bio-based materials and chemicals.
12. Development and application of technologies for capturing and using atmospheric carbon.

## **2. Sustainable use of resources and preservation of biodiversity**

1. Diversification of use of land, sea, and biomass; supporting the use of solutions that support biodiversity, habitats and soil health, reduce carbon footprint, increase carbon sequestration and help to adapt biomass production to climate change<sup>1</sup>.
2. Sustainable forest management<sup>2</sup>.
3. Improving and making available the data on the supply and demand of biomass and by-products (also at the regional and municipal level), and the development of the corresponding digital platforms.
4. Supporting the creation of bioresource collection, storage and pre-processing infrastructure.
5. Expanding the use of local plant species and varieties, including protein-rich fodder.
6. Promotion of algae and shellfish cultivation and processing technologies to remove nutrients from the Baltic Sea<sup>3</sup>.
7. Optimizing interactions between terrestrial, marine and aquaculture-based production systems to increase sustainability and production efficiency.

## **3. Research and development, innovation and technology**

1. Encouraging cooperation models and networks (enterprise cooperation, cooperation between enterprises and the state, international partners and research groups) within, above and between value chains for the development and introduction of technologies and the development of products and services with higher added value.
2. Supporting participation in international networks and consortia for using EU research and innovation funding opportunities (European Horizon, Interreg, etc.).
3. Supporting investments for the creation and development of innovative projects in cooperation of the state, public and private sectors for testing, piloting and technology scaling infrastructure (including offshore) and respective centres.
4. Development and introduction of small technological solutions suitable for community and regional levels.
5. Adaptation and application of the best practices and technologies of circular bioeconomy in Estonian conditions.
6. Application of IT solutions, including artificial intelligence, for the use of circular bioeconomy data and the development of products and services, the creation of digital cooperation platforms, optimization of processes and increased efficiency.
7. Improving the central access to state-ordered (applied) research and data in the Estonian Science Information System; communicating the possibilities of the system outside the academic circles.

<sup>1</sup> Among others, agroecology and regenerative agriculture, agroforestry, wetland agriculture, sustainable aquaculture and fisheries, and sequestration of "blue" carbon.

<sup>2</sup> The diversity and vitality of the forests ensure their renewal capacity and productivity. Carbon sequestration capacity of forests and adaptation to climate change is part of sustainable management. Renewal of forests is based not only on sustainability, but also on the needs of the circular bioeconomy of the future, in order to ensure wood that can be used for various purposes (chemical industry, construction, production of durable products, etc.).

<sup>3</sup> Including technologies for removing nutrients from inland water bodies and recirculating them.



#### 4. Competitive business environment

1. Ensure the state's contribution in the form of investments in infrastructure and the creation of piloting opportunities and the establishment of new bioresource processing units.
2. Creation of financing models to support start-up and spin-off companies of R&D institutions, including for reaching higher TRL levels.
3. Encouraging entry of start-ups and venture investors into the field of circular bioeconomy.
4. Provision of conditions and subsidies for the use of highly qualified labour, including foreign labour, in companies and R&D institutions.
5. Intensification of the involvement of private investments in solving the challenges of the circular bioeconomy; supporting or guaranteeing private sector (equity) investments and loans to reduce risks.
6. Supporting the participation of entrepreneurs in EU circular bioeconomy-related networks, partnerships and projects, as well as international circular bioeconomy and new technology fairs and other events.
7. Increasing the use of environmentally friendly (state) procurement in the areas of circular bio-economy, giving preference to products made from local resources (e.g., wood) or recycled materials.
8. Continuing to support the export and marketing of circular bioeconomy technologies, products and services.
9. Adapting the legal framework to the needs of the circular bioeconomy, especially speeding up the procedures, implementing EU-wide changes (e.g., state aid rules, rules of various EU funds) to facilitate, among other things, the introduction of new and innovative bio-based products to the market.
10. Empowerment of county-level development centres and municipalities (e.g., increasing the tax revenue base by the state) for the development of regional and community circular bioeconomy.
11. Updating the concepts of waste, residues and by-products and related requirements in legislation to promote the development of a circular bioeconomy.

#### 5. Education, skills and awareness

1. Systematic organization of dissemination and communication of the approach and principles of the circular bioeconomy as a new economic model.
2. Introduction of circular bioeconomy education at all formal education levels, knowledge transfer and training in order to prepare specialists with the necessary skills.
3. Creating a bachelor's curriculum in circular bioeconomy, offering circular bioeconomy-related micro-degrees in Estonian universities.
4. Organization of hackathons and similar events.
5. Training of municipalities on the topic of circular bioeconomy and their active involvement in the development of the field.
6. Introduction of joint action and cooperation models (e.g., different cooperative models) suitable at the community and regional levels.
7. Creation of a monitoring system for the supply and use of bioresources and the progress of the circular bioeconomy.
8. Empowerment of circular bioeconomy ambassadors and spokespersons.
9. Creation of "hands on" educational materials of circular bioeconomy for kindergartens and schools.

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