



EBC 2030

2030 CATALAN
BIOECONOMY
STRATEGY



Generalitat
de Catalunya

El Govern de
Tot Hom

2nd ACTION PLAN 2025-2027

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2025-2027

EBC 2030 2030 CATALAN
BIOECONOMY
STRATEGY



Title: **2025-2027 2nd Action Plan**

1st edition: October 2025

Interior photographs: Adobe Stock

Coordination:

Secretary General

Department of Agriculture, Livestock, Fisheries and Food

Text:

CTFC



IRTA

Institut
de Recerca i Tecnologia
Agroalimentàries



**Generalitat
de Catalunya**

tothom El Govern de



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1. Introduction

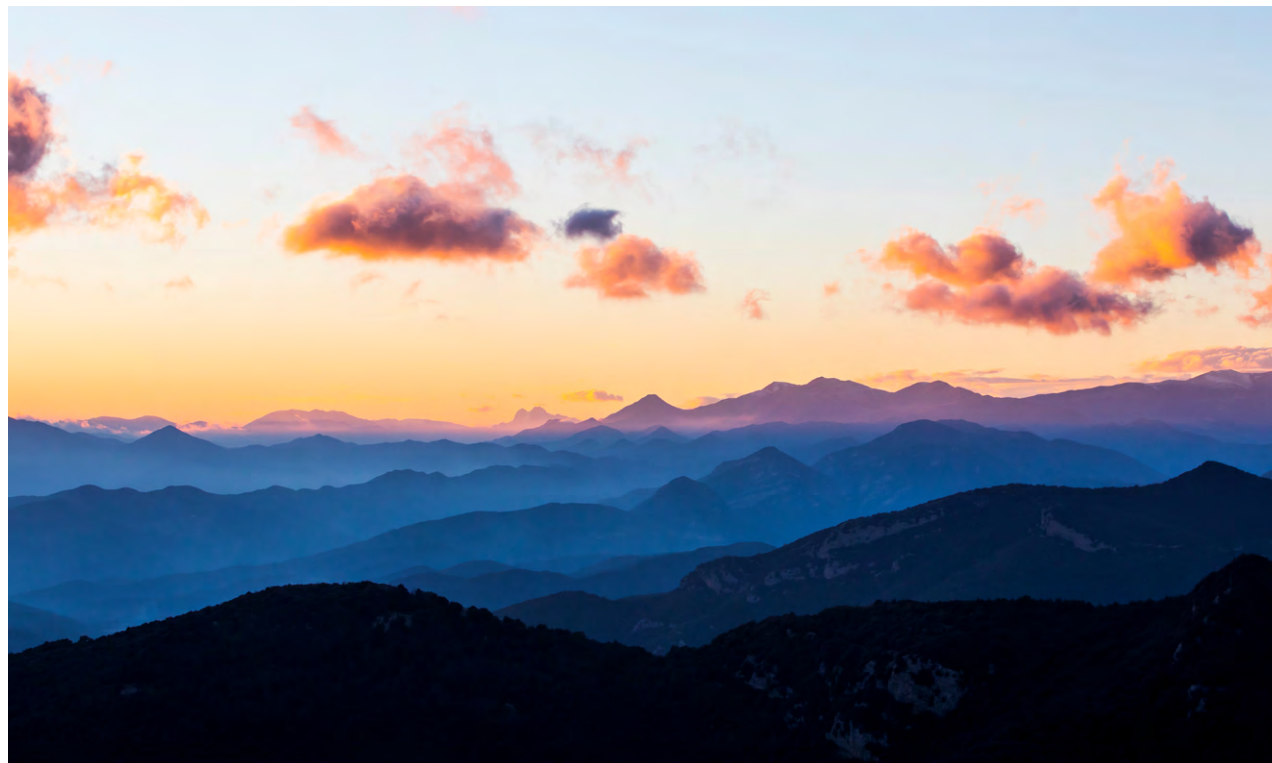
1. Introduction / Towards a well-rooted, efficient and shared bioeconomy

In a global context characterised by uncertainty, pressure on natural resources and the need to move towards more sustainable development models, the bioeconomy has been acquiring increasing relevance. Increasingly, international and European institutions identify this approach as one of the key levers to respond to the great challenges of our time: the climate crisis, the loss of biodiversity, dependence on fossil fuels, food and energy security, and the need to strengthen territorial and economic resilience.

This vision has been progressively taking shape at the European level through initiatives such as the European Green Deal, the Clean Industry Pact or the Biotechnology Act. The bioeconomy is presented as a commitment to an economy based on renewable, circular and local biological resources, capable of generating added value, employment and technological sovereignty. In this context, the European Commission has announced that it will publish the new European Bioeconomy Strategy by the end of 2025, with the aim of strengthening policy coherence, boosting innovation and ensuring a green and just transition on a continental scale.

In Catalonia, the economic impact of the bioeconomy is very significant and represents 16.5% of production and 9.8% of gross value added (GVA), and brings together around 650,000 direct and indirect jobs (CREDA-UPC-IRTA, 2022). These data reinforce the strategic potential of the bioeconomy as a driver of economic and social transformation in Catalonia.

For years, it has been incorporating this transformative vision through the Catalan Bioeconomy Strategy 2030 (EBC2030), approved in 2021 and executed through three-year plans. The strategy places the bioeconomy as an integrating pillar for multiple public policies and as an opportunity for the development of a more efficient, territorially balanced and environmentally responsible economic model.



During the period 2022-2024, the first action plan allowed for a qualitative leap in this direction. Although much remains to be done, the foundations have been laid for a more structured bioeconomy policy, with new instruments, shared knowledge and growing collaboration between actors.

Among the most relevant initiatives of this stage are the creation of the Agro-Food, Rural and Environmental Observatory of Catalonia and the BioHubCat, as a space to support companies and

entrepreneurship in the bioeconomy, the promotion of the Resilient Agroforestry Landscapes programme and systems for the valorisation of organic waste and livestock manure, or the development of the first industrial pre-scaling plants, which pave the way for future local biomanufacturing.

These actions have been made possible thanks to the joint work of various units of the Administration, the participation of research and technology centres, the commitment of many agents in the territory



and the support of European and national funding. However, it must also be recognised that some key areas are still in their infancy, such as the public procurement of bioproducts, the training of new professional profiles or citizen participation.

The new 2025-2027 Action Plan was born with the desire to give continuity to the processes initiated, correct dysfunctions, and consolidate a more mature, more transversal and more results-oriented bioeconomy strategy. The Plan is built on the conviction that the bioeconomy is not an end in itself, but a useful and flexible tool for generating quality employment, business innovation, environmental sustainability and territorial cohesion.

This period has as its central pillar the effective deployment of value chains based on the use of Catalonia's biological resources. This entails strengthening the connection between the production sector

(agriculture, livestock, forestry and fishing) and the transformation and demand sectors of biomass, especially in areas such as industry, materials and green chemistry. The Plan emphasises the need to make the transition from energy to material use, to multiply added value, improve environmental efficiency and strengthen technological sovereignty.

It also aims to deepen support for the manufacturing and industrial scalability of bioproducts, while seeking new ways of collaboration and knowledge transfer between research centres and companies. In this regard, it is linked to initiatives such as RIS3CAT 2030, which promotes innovation aimed at major social and environmental challenges.

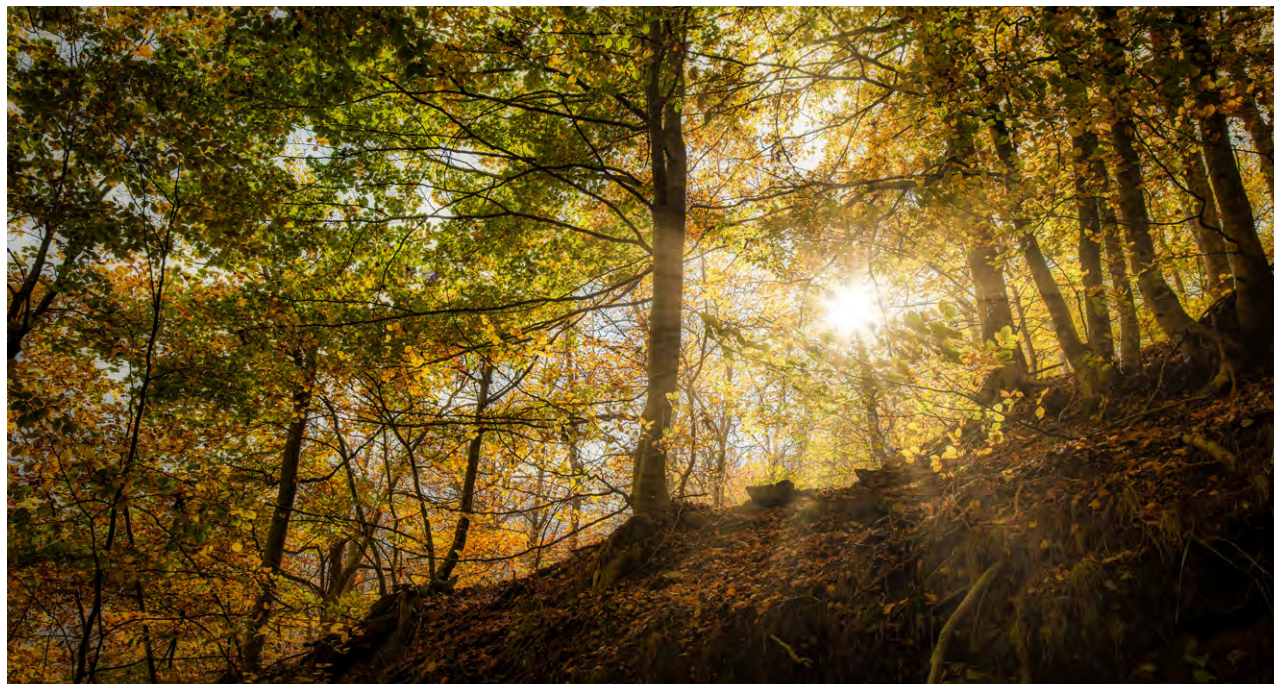
The 2025-2027 Plan aims to maintain its function as an integrating framework for Catalan sectoral bioeconomy policies and coordinate

with related policies such as the Food Strategy, the Maritime Strategy or the Circular Economy Roadmap. This articulation allows for optimising resources, avoiding duplication and promoting more coherent and efficient action.

The current moment is demanding. Catalonia is simultaneously facing several structural challenges: the climate crisis (with prolonged episodes of drought and high temperatures), the need to revitalise the rural world and establish a population in the territory, the urgency of achieving a fair energy transition and the desire to maintain economic competitiveness in an uncertain global environment. In this scenario, the bioeconomy can provide realistic solutions adapted to the territory if we continue to invest, collaborate and innovate.

The Plan does not intend to be a closed catalogue of actions, but rather an open and flexible proposal, built on accumulated experience and oriented towards continuous improvement. Its implementation will depend, to a large extent, on the active and co-responsible involvement of all agents: public institutions, companies, the local world, the primary sector, knowledge centres and civil society. In this regard, shared governance will continue to be an essential pillar.

This 2025-2027 Action Plan aims to contribute to progress towards a Catalan bioeconomy rooted in the territory, efficient in the use of resources and shared between diverse actors. A bioeconomy that is, beyond a strategic framework, a tool to build a more resilient, fair and viable future for present and future generations.





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2. Executive summary

2. Executive summary /

The key actions included in the 2025-2027 Action Plan have been designed to provide continuity to the deployment of the Catalan Bioeconomy Strategy 2030, reinforcing the lines of action already initiated and incorporating new initiatives with strong transformative potential.

The Bioeconomy Action Plan 2025-2027 is structured around four prioritised value chains which are maintained in a continuous manner with respect to the first plan (2022-2024). This approach ensures strategic coherence and continuity.

The commitment to consolidate projects initiated in the previous plan is also maintained, with a renewed focus on the material use of resources, shifting from the energy perspective to the material. This change in focus favours the optimisation of available resources and promotes a more circular model.

One of the notable new features is the broadening of the focus of the actions, which no longer only address the biomass supply, but also address demand, including new biomass user sectors, in order to promote its application and diversification.

In this context, a special emphasis is placed on creating economic opportunities, both for established companies and new initiatives, promoting the generation of jobs and the growth of emerging sectors.

Finally, the 44 actions within the Plan are grouped within 10 transformative actions, which bring together related interventions to promote coordination and effectiveness, contributing to a more coherent and structured deployment of all the different measures.

44
actions

8
featured
actions

€269,1
million
of investment
in 2025-2027

Featured performances /

Deploy and consolidate the Agri-Food, Rural and Environmental Observatory (TA1)

Support the development of three biopolygons (TA2)

Promote industrial precast plants (TA3)

Promote sustainable forest management (TA5)

Promote the installation of biogas plants and the treatment of organic material obtained in anaerobic digestion (TA6)

Increase the biological treatment capacity of the organic fraction of selectively collected municipal waste and municipal water purification sludge (TA6)

Deploy the Resilient Agroforestry Landscapes programme (TA8)

Develop the Climate Credit System of Catalonia (TA8)



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3. Context

3. Context /

The Catalan Bioeconomy Strategy 2030 (EBC2030), approved through Agreement GOV/141/2021, of 14 September, establishes an action framework integrated by 37 measures, structured into 7 strategic objectives and 17 strategic lines. The Department of Agriculture, Livestock, Fisheries and Food, in collaboration with the other departments and agents involved, has identified these measures as priorities for promoting the bioeconomy in Catalonia.

The deployment of the EBC2030 is specified through three-year action plans promoted by the Government of the Generalitat de Catalunya. These plans aim to progressively implement the measures defined in the strategy, as well as promote prioritised value chains.

Within this framework, the 2025-2027 Action Plan includes the set of actions that the Government plans to implement during this period, and defines **10 transformative actions**, designed to generate structural and long-term changes. Although these actions will be carried out within the established period, some may continue beyond the three-year period, given their strategic and transformative nature. The actions focus on the same **four value chains** prioritised in the first Action Plan (2022-2024), thus maintaining a continuous and coherent orientation with the trajectory initiated in the deployment of the EBC2030.

The strategic objectives (O), strategic lines (OL) and measures (M) that make up the EBC2030 are listed in detail in [table 1](#).

Table 1
Strategic goals, strategic lines and measures of EBC2030

O1 Improve the use of biomass in Catalonia through the characterisation, quantification and optimisation of its management and distribution			
O1 L1	Provide biomass data in a format which adds value for the users	M1	Integrate and complete the existing data on the circular bioeconomy in an observatory
		M2	Integrate systems of digitalisation and advanced data use
O1 L2	Ensure sustainability and efficiency in the management and distribution of biomass	M3	Facilitate biomass availability and quality
		M4	Prioritise the local recovery of organic matter and byproducts
		M5	Improve the management and distribution of biomass
O2 Develop a business community based on the circular bioeconomy throughout the territory, paying special attention to the primary sector			
O2 L1	Promote cooperative work between companies throughout the supply chain to attract supply and demand	M6	Develop the Bioeconomy Hub using existing infrastructures
		M7	Foster the creation of industrial symbiosis initiatives
		M8	Identify and inventory the value chains, necessary technology and market potential of bio-products, biomaterials and bioenergy while simultaneously geolocating producers, logistics operators, tech companies and end consumers
O2 L2	Strengthen the growth of existing companies based on the circular bioeconomy	M9	Reinforce lines of aid and funding for investment and development in circular bioeconomy
O2 L3	Provide incentives for the creation of new companies and business models based on the circular bioeconomy	M10	Foster the design of viability studies (economic, social and environmental) and business models
		M11	Reinforce lines of aid and funding for new businesses in circular bioeconomy
		M12	Facilitate the ceding of venues for the implementation of businesses

Continued from the previous page

Table 1 / Strategic goals, strategic lines and measures of EBC2030

O3 Encourage the use and consumption of bioproducts, bioenergy and biomaterials on the market			
O3 L1	Generate demand for the use and consumption of bioproducts, biomaterials and bioenergy	M13	Use tenders and public purchasing as a tool for furthering the circular bioeconomy
		M14	Spearhead communication and marketing plans and publicise success stories on bioproducts, biomaterials and bioenergy
O3 L2	Improve the positioning of bioproducts, biomaterials and bioenergy on the market	M15	Promote the commercialisation and differentiation of the bioproducts on the market and facilitate informed decision-making by consumers
		M16	Encourage manufacturers to affiliate themselves with environmental statements and labelling systems
O4 Promote resilient agricultural and forest landscapes and the sustainable provision of ecosystem services in the context of the Catalan circular bioeconomy			
O4 L1	Promote the establishment of resilient agricultural and forest landscapes using advanced tools and expertise	M17	Support a form of territory management which fosters resilient landscapes and the definition of priority areas for their establishment
		M18	Foster the creation of new economic activities which facilitate the management of resilient landscapes
O4 L2	Conserve and improve the quality of agricultural soils and foster their role as a carbon sink	M19	Foster a more sustainable form of organic fertilisation on agricultural soils
		M20	Implement agronomic practices designed to conserve and improve soil quality
O4 L3	Foster the provision of ecosystem services	M21	Identify ecosystem services in the context of the Catalan bioeconomy
		M22	Establish payment mechanisms for environmental services which favour territorial management and facilitate the social and economic viability of the territory

Table 1 / Strategic goals, strategic lines and measures of EBC2030

O5 Situate knowledge as a motor of the circular bioeconomy	
O5 L1 Promote research, innovation and technological transfer associated with the circular bioeconomy	M23 Identify the principal challenges and solutions and promote research/transfer/innovation projects linked to circular bioeconomy M24 Promote projects which enable proof of concept studies and the preindustrial and industrial escalation of new products and services M25 Promote technological improvements and technology-based companies, start-ups, spin-offs and scale-ups linked to the circular bioeconomy M26 Encourage companies to spearhead research and innovation projects in circular bioeconomy
O5 L2 Promote knowledge transfer and exchange	M27 Incorporate companies into collaborative spaces for processes of creativity and experimentation M28 Create a programme to capitalise on research and innovation linked to the circular bioeconomy and disseminate the knowledge and innovations generated by the programme M29 Provide advice about the circular bioeconomy throughout the value chain
O5 L3 Provide trained professionals and attract talent	M30 Train the existing professionals, develop new professional profiles and spearhead training projects linked to the circular bioeconomy M31 Reinforce the capacity to train and recruit talent in the sphere of the circular bioeconomy
O6 Strengthen the role of the Administration and adapt the legal and regulatory framework to favour the circular bioeconomy in Catalonia	
O6 L1 Adapt the legal and regulatory framework	M32 Identify and adapt the legislation and laws which could represent barriers to or opportunities for the development of the circular bioeconomy in Catalonia
O6 L2 Facilitate the implementation of circular bioeconomy activities in the territory	M33 Develop the Bioeconomy Office M34 Orient and coordinate funding sources (European, national and local) to provide impetus to the circular bioeconomy
O7 Prepare Catalan society for the change toward the circular bioeconomy	
O7 L1 Inform and raise awareness among the citizenry on the need to implement, and the benefits of, the circular bioeconomy	M35 Promote awareness-raising and publicity campaigns aimed at citizens to improve their perception of the circular bioeconomy M36 Integrate the circular bioeconomy into educational and training curricula
O7 L2 Incorporate civil society into the design and execution of new projects associated with the circular bioeconomy	M37 Design a system of co-governance with the citizenry and all other parties involved

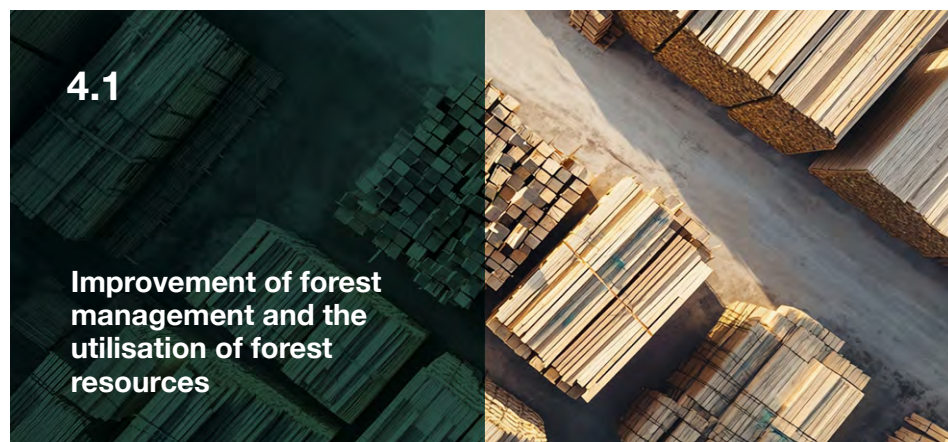


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4. Value chains

4. Value chains /

The main objective of this Action Plan is to promote the development and strengthening of various strategic value chains for the territory. In this regard, priority has been given to those areas that, despite their potential, are currently in an incipient or less consolidated state of development, with the aim of generating new economic and social opportunities. This new Plan continues the line of work initiated with the previous one, taking advantage of the experience acquired and expanding its scope to strengthen the prioritised sectors.



Value
chains

4.1 /

Improvement of
forest management
and the utilisation
of forest resources



4.1 / Improvement of forest management and the utilisation of forest resources

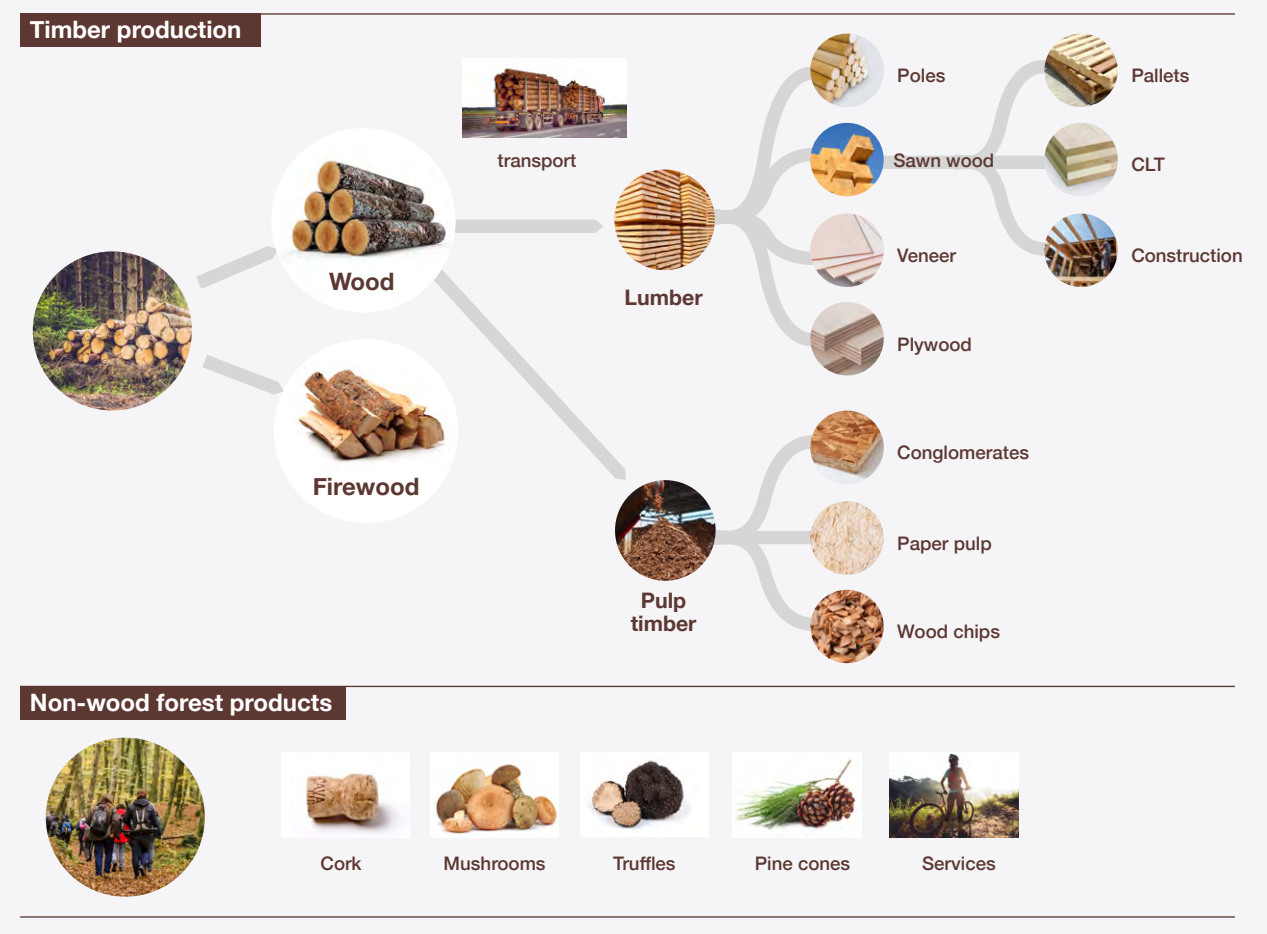
4.1.1 Description

In the current context of the forests of Catalonia, which represent **more than 65% of the current surface**, improving forest management and the use of forest resources is key to moving towards a circular bioeconomy in Catalonia.

The wood value chain comprises two main flows: wood uses, which include industrial wood (construction wood, crushed wood and all its products and by-products) and firewood, and non-wood products (see [Figure 1](#)).

Figure 1

General outline of the forest value chain / Source: CTFC



4.1.2 Current valorisation routes

Valorisation of the forestry chain

Currently, the valorisation of the forestry chain has three main product lines (see [Table 2](#)): wood for industry, chips and firewood. The last two are intended for the generation of bioenergy (190,270 m³ and 289,701 m³ respectively in 2022). Regarding wood for industry, the four destinations in Catalonia are: sawmills, the production of cross-laminated timber (CLT), the production of poles, posts and stakes, and shredding for export. Table 2 also specifies the origin of the wood roll used in the industry and distinguishes between imported (133,838 m³) and that produced in the country (454,993 m³), and also shows the final result of the industrial transformation,

whether it is a finished product or the different types of by-products (chips, sawdust and bark).

As can be seen, 1 million m³/year of wood is extracted from Catalan forests, of which 57% enters the primary processing industry (mainly sawmills), 26% is used for firewood and the remaining 17% is turned into woodchips for energy uses.

In terms of industrial production, the largest proportion (41% of the total cut in Catalonia) goes to the production of sawn wood and to the secondary processing industry, mainly containers and packaging. In any case, the production of poles, lathed pieces, posts and stakes is also significant (9%), as well as the shredded wood that is

exported for the production of paper and boards (7%). On the other hand, the manufacture of CLT currently only absorbs a discreet 0.6% of Catalan wood production, despite its great advantages as a construction material.

Regarding the by-products of wood processing, there are three types: chips, sawdust and bark, of which a total of 424,271 m³ are generated that end up on the market as pellets, cattle litter, etc. This amount, added to the chips and wood for bioenergy, makes a total of 904,243 m³ of forest by-products generated in Catalonia.

Table 2
Production within the forest chain in Catalonia (year 2022).

Source: Forest use statistics from the DARPA and the IDESCAT Industrial Product Survey. To make the figures of the source data comparable, they have been unified and simplified to m³ by counting densities of 1 t/m³.

LINES OF WORK IN THE FOREST	INDUSTRIAL DESTINATION	WOOD ROLL (m ³)		MANUFACTURED PRODUCT (m ³)	BY-PRODUCTS (m ³)			TOTAL FOREST BY-PRODUCTS (m ³)
		Import	Catalan		Woodchips	Sawdust	Bark	
Industry	Sawmills	133.838	454.993	214.335	190.192	95.980	88.325	374.497
	CLT		6.531	2.377	2.110	1.065	980	4.154
	Poles, lathed pieces, posts and stakes	27.454	99.271	81.104	20.276	7.604	17.742	45.621
	Shredding (export)		74.453	74.453				
Chips for energy			190.270					190.270
Firewood			289.701					289.701
TOTAL wood roll (m ³)		161.292	1.115.219		TOTAL FOREST BY-PRODUCTS (m ³)			904.243

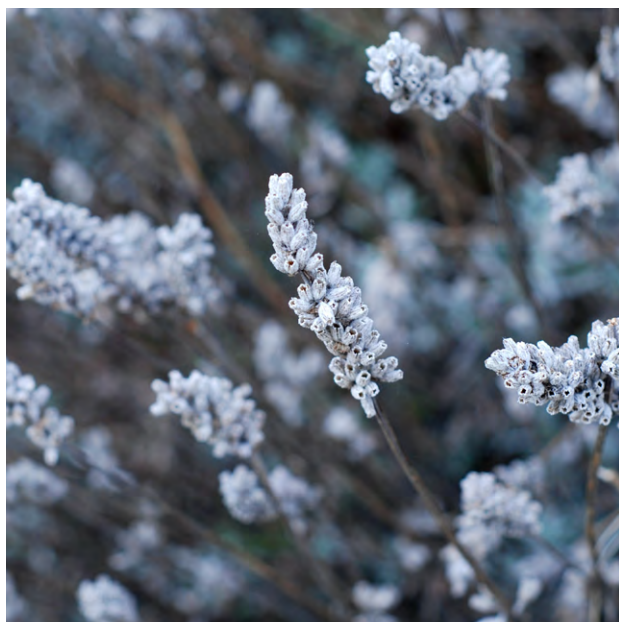
Non-carpentry products

Among the non-timber forest products, the most relevant in Catalonia are **mushrooms**, with production that varies greatly depending on the year. As an average, the production for the period 2019-2023 was 35.1 kg/ha. In terms of commercial production, 1,012 tonnes were traded in 2023, although the annual average for the 2019-2023 period was significantly higher, at 2,331 tonnes. It should be borne in mind that 2018 was a year of great mushroom production, with a total of 10,710 tonnes.

As for other non-timber products, **black truffle** production in the 2023-24 season was 2,300 kg, while the average annual production in the period 2019-2023 was 2,834 kg.

The production of **white pine nuts**, meaning the nuts that are the seed of the fruit (pine cone) of the pine tree (*Pinus pinea*) came to 28 tonnes in 2020, similar to the annual average of 26 tonnes in the period 2014-2019. Regarding **wild aromatic and medicinal plants**, in 2020 the uses on public land were 22 tonnes of bearberry and 1.30 tonnes of medicinal plants.

The lack of a regulatory framework, in addition to poaching and the impact of pests and drought, are the main cause of the low economic impact of non-timber products in the forestry sector. In this regard, consolidation in the regulation and traceability of its marketing must be a priority.



4.1.3 Opportunities

This Action Plan aims to promote the development of the following value chains in the forestry sector through the bioeconomy:

Valorisation of the forest chain in the bioeconomy scenario

The EBC2030 proposes to implement a bioeconomy scenario in which the production of wood roll in Catalonia increases by 30%. This entails increasing the production of wood roll to 1,334,000 m³ (Taule 3). This increase is justified below:

- The increase in **aerial biomass**, in the form of volume of wood with bark, accumulated in the forests of Catalonia has exceeded 118,117,666 m³ (2001) at 151,492,338 m³ (2015) (Forestry Observatory of Catalonia). Therefore, every year 2.2 million m³ of biomass are accumulating in Catalonia.
- The **extraction rate** of wood from these forests is approximately one million m³ per year, with a certain decline in recent years and stability at 0.25 million tonnes of firewood per year. This scenario is expected to increase with the proposals foreseen in the General Forestry Policy Plan (pending approval) which set a horizon of doubling the current utilisation rate until 2040.
- In the current context of **climate change**, this accumulation of biomass is unsustainable and puts Catalonia at great risk of large fires, as have already begun to occur in other areas with a similar climate (California, Oregon, Australia, Chile, Portugal, Greece or Italy).
- The need to reduce the current **external dependency** on wood. Currently, the consumption of wood-derived products is almost



7 million m³ of apparent wood rolls (internal source), while only 1 million are produced.

- To turn this situation around, taking the extraction rate as an indicator, it is considered essential to set, as a long-term objective (2050), reaching the European level of **extraction and use of our forests**. This would aim to increase these annual uses to 2 million m³. However, it is possible that the conditions generated by the climate change context will limit the future growth of these ecosystems, but it is considered that the uses should be maintained to reduce the current concentration of biomass.
- It is also true that over the decades we have not been able to increase the **use** of Catalan forests. For this reason, a progressive objective is proposed that would mean going from the current 30% growth in the use rate to 40% in 2030 (1,334,000 m³) and 60% in 2040 (2 million m³ approximately).



Table 3
Projected productions in the forestry value chain of Catalonia in a bioeconomy scenario for 2030.

Source: CTFC

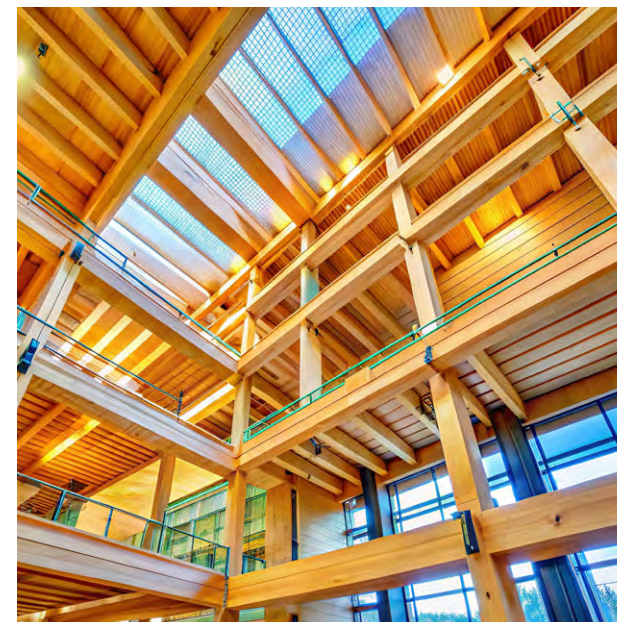
FOREST WORK LINES	INDUSTRIAL DESTINATION	ROLL WOOD (m³)		ELABORATED PRODUCT (m³)	BY-PRODUCTS (m³)			TOTAL FOREST BY-PRODUCTS (m³)
		Import	Catalan		Wood chips	Sawdust	Bark	
Industry	Sawmills	5.000	595.000	218.400	193.800	97.800	90.000	381.600
	CLT	5.000	99.000	37.856	33.592	16.952	15.600	66.144
	Sticks, turning, hangers and stakes	5.000	95.000	64.000	16.000	6.000	14.000	36.000
	Crushing (export)		90.000	90.000				
Wood chip for energy			200.000					200.000
Firewood			255.000					255.000
TOTAL wood in roll (m³)		15.000	1.334.000		TOTAL FOREST BY-PRODUCTS (m³)			938.744

This initial increase would ensure:

- Covering the needs of the current **Catalan packaging industry** (which is essential to maintain and increase forest management) without depending so much on imports and also anticipating a 30% growth in its production. Currently, this industry is not able to grow due to the lack of raw materials, although there is a strong demand for pallets due to the dynamism of Catalan exports.
- Having almost 100,000 m³ of wood roll for the development of a **second transformation forestry** industry that valorises the highest quality wood for construction.
- Producing raw materials for the **Catalan wood guild** that could cover part of the demand for furniture made with local wood.
- **Maintaining** companies that work with turnings, poles, posts, etc.
- Guaranteeing the **export** commitments of some Catalan companies to external paper mills.
- Supplying biomass to the current **power generation plants and thermal boilers**, as well as providing the increase foreseen in the Strategic Plan to promote the energy use of forest and agricultural biomass in Catalonia 2021-2027.
- Maintaining current firewood production, which has remained relatively stable for many years and we believe will not increase.

This 30% increase is an acceptable amount compared to the current annual production of Catalan forests and is in line with the sustainability values assumed in the General Forest Policy Plan, which set an even higher target than this percentage.





Wooden construction

Building in wood involves a reduction in the use of materials, waste and installation time, and has greater thermal efficiency compared to cement and lower CO₂ emissions. For every tonne of wood used in construction, 4 tonnes of CO₂ in the atmosphere are avoided.¹ The development of new wood-based materials, such as **CLT** (cross-laminated timber), is an opportunity to increase the use of wood in the construction sector and thus improve energy efficiency and reduce CO₂ emissions in this sector.

According to the available data from 2022, out of the total of 1 million m³ of wood roll from the forests of Catalonia, only 2,300 m³ were destined for the production of CLT. The Grup Boix plant will be

launched at the end of 2025 and will position the group as a main producer of CLT in Catalonia with 20,000 m³ each year, a planned investment of around €35 million and employing around 20 people.

In this future bioeconomy scenario, the availability of almost 100,000 m³ of wood roll for the implementation of a second transformation industry to manufacture CLT would allow the highest quality wood to be valued to the maximum. It is also justified by the economic improvement of the forestry chain and the greater generation of jobs.

It is essential to intervene in the design and prescription of buildings and public works, both in the field of public and private developers and in architectural firms. These agents have great potential to promote the use of wood in construction, but to do so it is essential that they know the properties, performance and specific construction solutions of these materials.

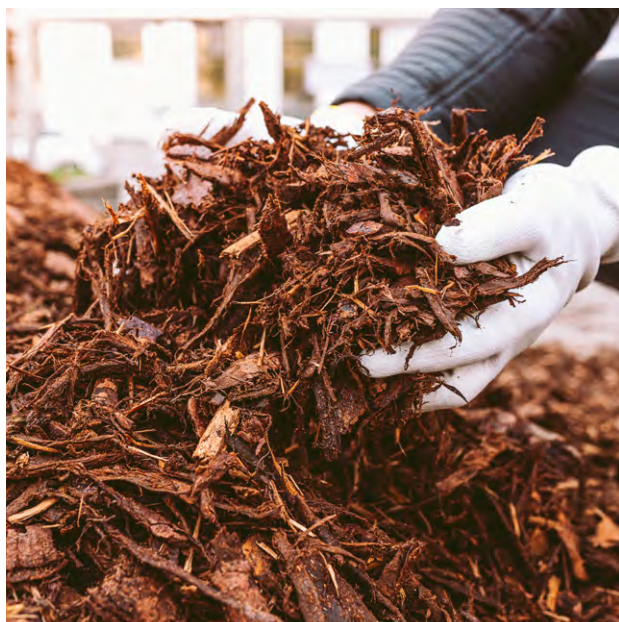
Along these lines, the UPC already offers training in wood construction as an optional subject within architecture studies. For its part, the CTFC plans to maintain its economic contribution and the provision of the forestry hub facility for the development of this subject. In addition, the General Directorate of Forests and Environmental Management is leading actions to promote the use of wood and cork in construction, to contribute to the decarbonisation of the sector by promoting the use of these sustainable and local materials, facilitating the advice of the CTFC and the Catalan Cork Institute (ICS) to help overcome current barriers in this area.

¹ Using wood instead of other materials in construction means, on average, ceasing to emit 2.1 t of carbon, 3.9 t of CO₂-eq (Sathre and O'Connor, 2010. Environ Sci Pol 13(2):104–114).

Forest biofuels

Forest biofuels include firewood, wood chips and pellets from the first transformation processes, as well as from the second transformation of the wood industry. The Strategy to promote the energy use of forest and agricultural biomass includes this use as a line of action for the Government due to the significant energy, environmental and socio-economic benefits it entails. It is considered that the CO₂ balance of biomass combustion is neutral, except for the extraction and transport processes.

In the current context of the forests of Catalonia, the use of forests to produce this type of biofuels represents an environmentally and economically sustainable future option; moreover, without a paper industry consuming Catalan wood or a shredding industry, bioenergy is essential to provide a commercial outlet for these products



with lower added value.

The EBC2030 proposes to implement a bioeconomy scenario in which the production of wood roll in Catalonia increases by 30%. The increase in biomass production for energy purposes will occur directly and indirectly from industrial by-products. In this regard, an increase in forest biomass is projected to reach 938,200 tonnes (50% humidity) in 2030; of which 48% relates to wood chips, 27% to firewood, 13% to sawdust and 12% to bark.

A significant reduction in the export of industrial wood chips is expected, a slight increase in the consumption of firewood and electricity from biomass and a continuous growth in the consumption of wood chips for thermal and pellet purposes, in accordance with the 2021-2027 Strategic Plan to promote the energy use of forest and agricultural biomass in Catalonia.

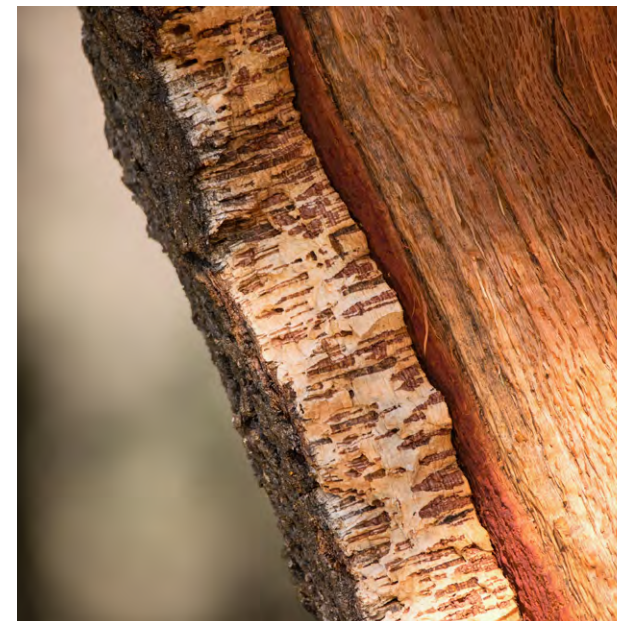


Cork

Cork is a material with a high capacity for regeneration and a combination of properties that make it unique, versatile and suitable for a multitude of applications for various sectors: among them, lightness, impermeability, low heat and sound transmission and high compressibility, elasticity, flexibility, durability, stability and rigidity stand out.

Possible applications include the manufacture of structural elements in construction (to reduce the weight of structural elements, as an anti-vibration element and thermal and acoustic insulator) and coatings in construction and industry, use in decoration and fashion and energy applications.

According to data from the Forest Observatory of Catalonia, cork production in 2022 was 4,400 tonnes, of which 3,209 tonnes corresponded to reproduction cork and the remaining 1,191 tonnes to the use of the virgin cork trees.² For the period 2018-2022, annual cork production in Catalonia was 6,247 tonnes on average.



² Source: <https://www.observatoriforestal.cat/produccio-de-suro/>



Other innovative uses

The potential for innovative uses lies in both non-timber forest products—such as resin, mushrooms, truffles or aromatic and medicinal plants—and timber forest products, where biorefineries will play a key role in the coming years as they involve producing value-added products from different forest products.

Part of the production of bioproducts is part of integrated forest biorefineries through which a wide variety of products are produced, with the aim of obtaining the maximum benefit from the various components of lignocellulosic biomass (cellulose, hemicellulose and lignin), which maximises the added value of the products obtained from them (biomaterials, biofuels, bioproducts and bioenergy).

Biorefineries allow the production of various high-value bioproducts, such as chemicals, fertilisers, nanocellulose, additives and active ingredients for the cosmetic and nutraceutical industries, through thermochemical or biological processes from forest biomass, as well as agri-food biomass, sludge and slurry. The implementation of these industries is presented as an opportunity to valorise wood of little commercial value and residues from thinning and pruning, thus increasing the profitability of the management of forest areas.

The Baix Montseny bio-industrial park, promoted by the Sant Celoni Municipal Council and the CTFC, will contribute to the establishment of the first commercial biorefineries based on needs studies and research in this new field.

Regarding mushrooms, their use is not restricted solely to food, but new applications are identified every day such as muskin, an alternative to animal skin, as natural biodegraders of strains, by isolation through the use of fungi as a renewable substitute, new medicinal products, not only for use in humans, but also in insects, such as bees, which are fundamental in pollination, among others.

4.2 /

**Valorisation of
livestock manure
and other organic
waste**



4.2 / Valorisation of livestock manure and other organic waste

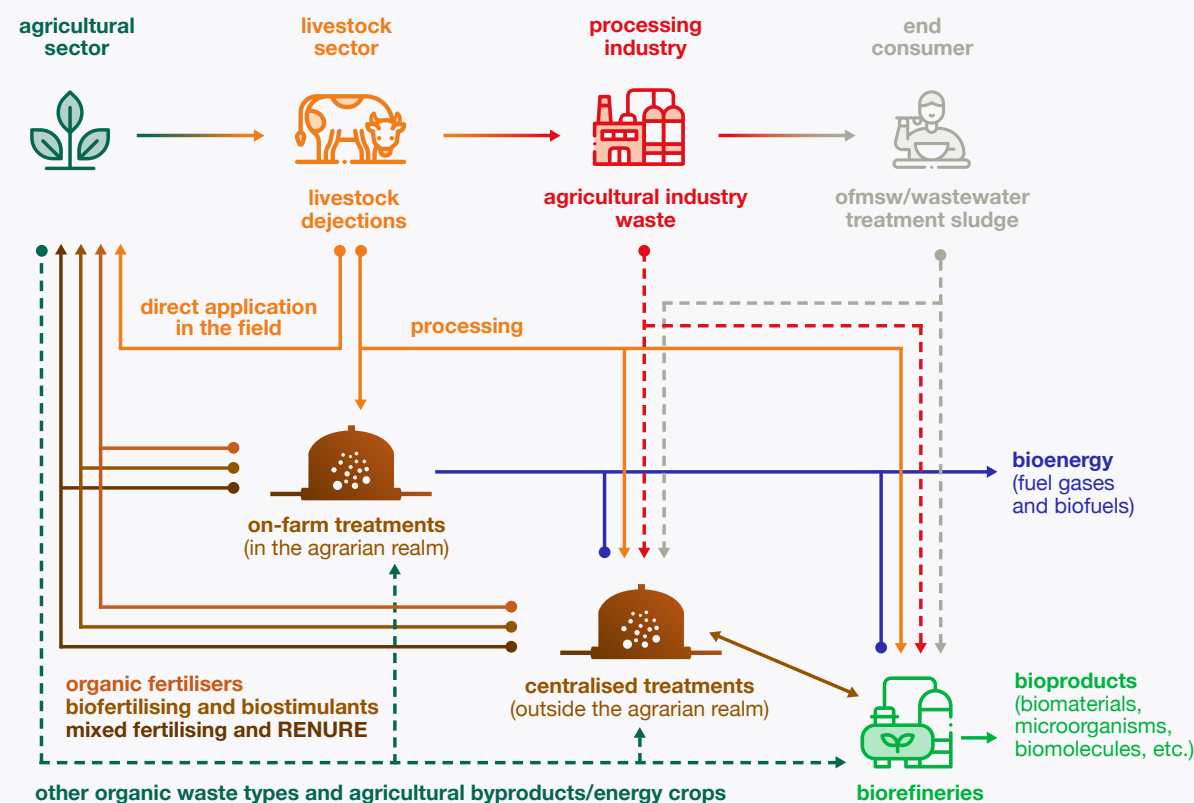
4.2.1 Description

During the period of the first Action Plan of the Catalan Bioeconomy Strategy (EBC2030), in force between 2022 and 2024, a series of events have occurred that have highlighted the urgency of promoting initiatives based on the bioeconomy, especially in the field of agricultural nutrient management. The Russia-Ukraine war, on the one hand, has had a major impact on the increase in the costs of basic resources such as natural gas which is, among many other uses, essential for the manufacture of inorganic fertilisers. Consequently, food products have also risen significantly in price. On the other hand, the global effects of climate change are increasingly frequent and severe (extreme weather events, persistent droughts, large fires, etc.), and the manufacture of inorganic fertilisers and the management of organic waste are major contributors to greenhouse gas (GHG) emissions.

There is an urgent need to find more environmentally and socio-economically sustainable solutions for replacing non-renewable resources, such as inorganic fertilisers and fossil fuels. In this context, the recovery of livestock manure and other organic waste represents, more than ever, a key opportunity. In the case of waste, we refer to slurry, manure and chicken manure, while organic waste that is produced on a massive scale includes sludge from urban wastewater treatment plants (WWTP) and the food industry, the organic fraction of municipal solid waste (MWW), organic matter in the residual fraction (MOR), and agri-food and organic industrial waste.

Figure 2
Diagram of the chain of livestock manure and organic waste.

Source: IRTA



4.2.2 Current situation

Generation of livestock manure and organic waste

The amount of livestock manure and organic waste generated in Catalonia has remained relatively stable in recent years.^{3,4} While the production of livestock manure is around 12.6 million tonnes per year, that of organic waste is an order of magnitude smaller, at 2.6 million tonnes per year (Figure 3). Of these quantities, nearly 16% of livestock manure is processed, with greater implementation of separation systems (8%), composting (3%), anaerobic digestion (2%) and drying (1%).³ On the other hand, organic waste cannot be applied directly to the field and requires prior treatments which are predominantly composting (30%) and anaerobic digestion (26%). The treatments that are applied to organic waste when it is generally not suitable for agronomic valorisation are biostabilisation (13%), thermal drying (1%) or others (20%). Only a small fraction of organic waste (0.4%), mainly industrial sludge, is deposited in controlled landfills.

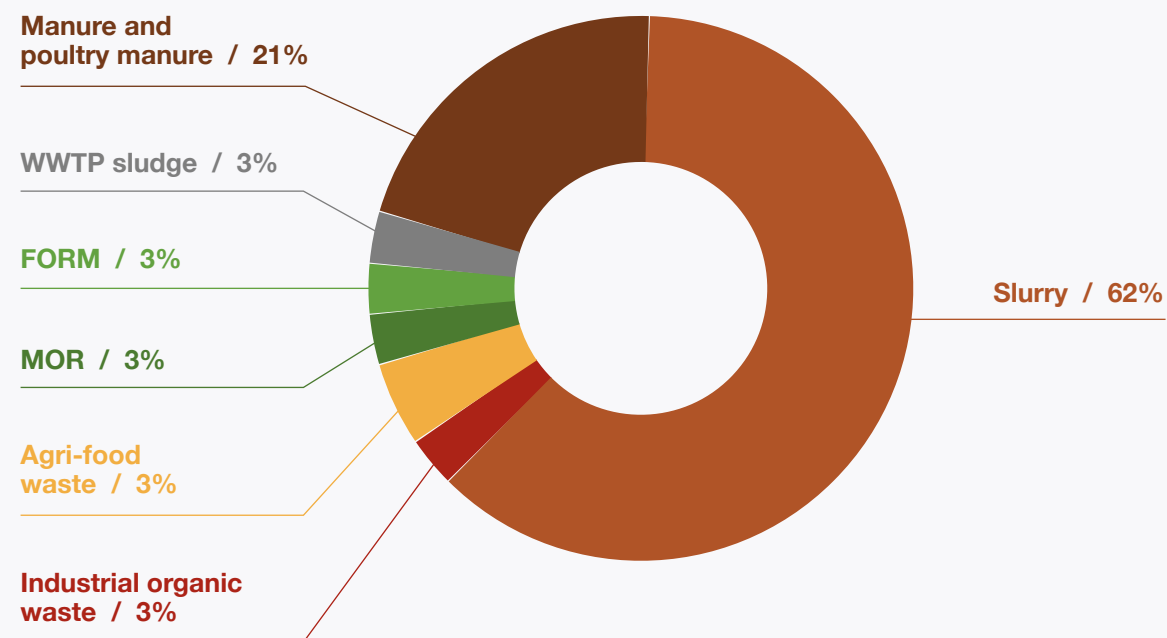
³ Catalan Biogas Strategy and Action Plan 2024-2030.

⁴ Technical dossier no.127 "Towards a circular bioeconomy in Catalonia", RuralCat

Figure 3

Relative quantity of livestock manure and potentially recoverable organic waste generated in Catalonia according to its origin, out of a total annual generation of 15.3 million tonnes.

Font: DARPA



Agricultural nutrient demand

The consumption of inorganic fertilisers in Catalonia, especially synthetic nitrogen fertilisers, decreased by 25% between 2022 and 2023.⁵ This fact is necessarily associated with the increase in the prices of inorganic fertilisers and has led to an increase in organic-based fertilisation. The organic fertilisers that result from treatment processes (compost, digestate and other more or less stabilised and enriched fractions) have a more homogeneous and balanced composition of nutrients than the original materials, and greater biological stability. This allows a more precise application adapted to the specific needs of the crops. This precision in application contributes to significantly reducing the risk of nutrient leaching, thus minimising nitrate pollution of groundwater and the accumulation of phosphorus in soils. In addition, processed fertilisers allow for better availability of nutrients to plants, reducing the need for excessive applications and, therefore, decreasing ammonia and GHG emissions that are generated during storage and agronomic application.

Despite the benefits of treatments, 84% of livestock manure generated in Catalonia is still applied directly to the field, without any prior processing, indicating that there is still a lot of work to be done. In similar livestock powers, such as Denmark, during 2023, 33% of the manure generated was treated through anaerobic digestion,⁶ fundamentally in combination (co-digestion) with other organic waste.

Regarding the agronomic valorisation of organic waste, approximately half of the 0.5 million tonnes of WWTP sludge produced in Catalonia is applied directly to fields, mainly in winter cereal crops

⁵ MAP, ANFFE (2024 data is not yet available).

⁶ Agriland.

Figure 4
Fertilisation trial of experimental plots with WWTP sludge.

Source: IRTA



such as barley⁷ (in this case, the sludge must have been treated at source through anaerobic digestion). The rest of the sludge is managed in composting plants, where it is mixed with other organic materials to produce compost and, if it does not meet the criteria established in the regulations, usually due to having a concentration of heavy metals that is too high, it is destined for disposal via landfill. Similarly, out of the 0.4 million tonnes of FORM generated, approximately half is valorised through composting and the other half through anaerobic digestion, and the destination of the com-

⁷ IRTA.

post and digestate produced as fertilisers and amendments is for agriculture, urban gardening and soil restoration. On the other hand, with regard to agri-food waste, 43% of the 0.7 million tonnes of annual generation is recovered within the same sector. The rest, around 0.4 tonnes, are processed in composting plants to obtain good quality compost or in anaerobic digestion plants, which produce biogas and digestates, which are also used in agriculture.

Infrastructure and processing facilities

In line with the increase in the amount of processed manure, during the validity of the 2022-2024 Action Plan, Catalonia has experienced notable growth in the construction and commissioning of new manure, slurry and chicken manure processing plants, both within and outside the agricultural framework. Currently, there are a total of 345 plants that process livestock manure, either alone or mixed with other waste or organic materials.⁸ More than 75% of these facilities are located on livestock farms, while the rest correspond to centralised plants that serve multiple farms.

The main causes of this rapid growth are associated with the interest in organic fertilisation, due to the high costs of the inorganic fertilisers mentioned above. Furthermore, in the case of anaerobic digestion, it is necessary to add the incentives brought about by the high price of natural gas and the possibility of offsetting carbon credits through the purification of biogas into biomethane (upgrading⁹), for subsequent injection into the gas network.

The demand for substrates to feed the growing number of anaerobic digesters particularly affects waste from the agri-food industry, a sector with great importance in Catalonia. The diversity and types of waste produced by the agri-food sector is very large, as is the plurality of industrial areas and production processes where they are generated (slaughterhouses, fruit and vegetable processing, wine and oil processing, etc.). This variety of waste opens up a significant opportunity for its joint valorisation with livestock manure through anaerobic co-digestion processes¹⁰, a strategy that allows the optimising of biogas production and improvement of process efficiency.

⁸ Fertilisation Office.

⁹ Biogas purification process to increase its methane concentration and eliminate impurities, converting it into an energy vector suitable for use as vehicle fuel or injection into the natural gas network.

Unlike livestock manure and waste from the agri-food industry, the management of FORM, MOR and WWTP sludge is usually led by public-private consortia whose main objective is the treatment of organic waste from an end-result perspective, focusing on its elimination or transformation to comply with environmental regulations. Regarding the FORM, more than 800 municipalities have implemented selective collection which is subsequently treated in one of the 25 composting plants registered as waste managers, with the aim of producing valuable compost for agriculture (four of these facilities also incorporate a prior anaerobic digestion process). The rest of the rural and small municipalities promote self-composting, either on a household or community scale. However, too much MSW is still found within the remaining fraction of municipal waste. This material is destined for landfill, but is previously treated biologically (bio-stabilisation) to avoid emissions. It is therefore necessary to improve separation and implement more efficient collection systems that capture this organic fraction so it can be valorised as a resource.

Regarding the water purification sector, there are currently almost 550 WWTPs spread throughout Catalonia. The main way of valorising WWTP sludge is using it in agriculture, either through direct application (in the case of sludge treated at source, mostly through anaerobic digestion) or through a previous process in composting facilities. Sludges that do not meet the criteria established in the regulations due to their having too high a concentration of heavy metals are destined for disposal via landfill.

¹⁰ Mixture of different types of organic waste that are degraded simultaneously in anaerobic digesters to improve energy efficiency and process performance compared to the digestion of a single type of waste.



Barriers to the valorisation of livestock manure

The experiences of recent years have highlighted the difficulties faced by promoters of livestock manure treatment and recovery plants, especially centralised, large-scale ones, or those that incorporate more technical or innovative processes. Regulatory and administrative complexity constitutes a first important obstacle, with authorisation processes and obtaining environmental licences often being long and costly, which delays the start-up of the facilities. Economic barriers are another key challenge, as the initial investment required to build and operate a treatment plant is usually high, while profitability can only be achieved in the long term in many cases. Therefore, dependence on public aid is high, while access to private financing is made difficult by the perception of risk associated with the sector.

From a technical point of view, there are also important limitations, especially when one wants to adopt innovative solutions and integrate cascading processes, with a biorefinery vision, as will be discussed later. It is necessary to take into account logistical and infrastructure aspects that could condition the deployment of new facilities in rural areas (availability of well-connected transport routes, access to electricity and gas networks, etc.).

No less important are the social and perceptual barriers within local communities and even the livestock sector, which often associate treatment plants with being a potential source of nuisance, which tends to generate opposition to many projects. The lack of knowledge about the environmental and economic benefits among livestock farmers and other actors in the rural sector often makes it difficult to accept and adopt these sustainable solutions.



The challenges of anaerobic digestion and biomethane

Biomethane has become a fundamental pillar for promoting sustainability and the bioeconomy, as it allows organic waste to be valorised, greenhouse gas emissions to be reduced and an energy transition towards a more circular and decarbonised model to be promoted. Since the inauguration, at the beginning of 2022, of the first facility certified to market biomethane, Catalonia currently has a growing number of biomethane plants in operation. Today, there are about seven plants that inject biomethane into the natural gas network for a total of nearly 200 GWh of equivalent energy per year. In total, in Catalonia there are around 72 anaerobic digestion plants that mostly valorise biogas by converting it into electrical energy and heat through cogeneration systems.



This accelerated growth of the biogas or biomethane sector poses significant challenges, such as the need for sustainable management of organic waste, the risk of hoarding raw materials for anaerobic digestion to the detriment of other more sustainable uses, and the environmental and territorial impact that could arise from an uncontrolled expansion of biogas infrastructure elements. It can also lead to underestimating the importance of properly managing and valuing the increasing quantities of resulting digestate. This material contains valuable nutrients that can be used as organic-based fertilisers, but its concentration and inadequate management can lead to environmental problems, such as soil and groundwater contamination with excess nutrients. Therefore, it is essential to plan its



management and, if necessary, implement post-treatment processes for the digestate to stabilise it and extract the nutrients it contains to obtain fertiliser products that are safer, more effective and easily exportable.

Furthermore, the growing demand for raw materials for biogas production may encourage competition for organic waste, increasing prices and encouraging speculation. This situation can lead to a concentration of economic benefits in the hands of a small number of actors with the capacity to invest in anaerobic digestion technologies and the associated logistics, leaving aside small producers or local communities. To avoid these consequences, it is necessary to promote decentralised management models that allow for a more equitable distribution of profits and ensure sustainable management of organic waste.

In this context, the [Catalan Biogas Strategy and Action Plan 2024-2030](#) has set the objective of promoting the generation of

biogas through the anaerobic digestion of livestock manure and organic waste, through a model based on territorial and socio-economic balance. The quantitative objectives to be achieved during its term include increasing the management of organic materials to 8.5 million tonnes per year, tripling the current management capacity, to produce 2 TWh of annual renewable energy from biogas and biomethane, and reducing GHG emissions by more than 350,000 tonnes of CO₂ equivalent. To make this possible, it is necessary to promote co-digestion plants with livestock manure and various types of waste, expand and modernise existing infrastructure elements, promote our own technological development, and provide financial aid and support instruments for local projects. It is also necessary to establish a governance system that guarantees equity, transparency and efficiency in monitoring and continuous improvement during the implementation of the Action Plan.

In coordination with the Catalan Biogas Strategy and the 2024-2030 Action Plan, the [Catalan strategy for digestate 2024-2030](#) was also drawn up. The purpose is to guarantee sustainable management of the digestate generated in Catalonia, and promote its transformation into biobased fertilisers with high added value. In this way, the aim is to reduce the consumption of mineral and synthetic fertilisers, create new business models in the field of fertilisation, promote technological innovation and improve the professionalisation of the sector. The Catalan Digestate Strategy also aims to promote water recovery in a context of climate change and water scarcity, establishing a favourable regulatory framework and facilitating the creation of a market for products derived from digestate to strengthen the agricultural and environmental sustainability of Catalonia.

Regulatory developments and incentives

During the 2022-2024 Action Plan, important developments and advances have occurred involving aspects related to the regulations on the processing and recovery of livestock manure and other organic waste, whether at the regional, state or European levels:

- Within the agricultural framework, desorption (stripping) and ammonia absorption technologies, and membrane separation have been recognised as [consolidated treatments](#) by DARPA. These treatments are added to those already accepted (solid-liquid separation, anaerobic digestion, composting, nitrification-denitrification, and solar drying), and are of special relevance for the post-processing of the digestate.
- Regarding the development and implementation of innovative treatments in the management of livestock manure at source, which have not yet been recognised as consolidated in the regulatory aspect (see the previous point), DARPA has launched a new line of [grants](#) for its development and subsequent validation.
- Following the entry into force of [Royal Decree-Law 14/2022](#), which regulates the conditions for the conversion of biogas into biomethane, and its injection into the natural gas network, several lines of aid have been announced for the construction of plants for the production of biogas and biomethane. These initiatives have been promoted by the Catalan¹¹ and Spanish administrations,¹² often with European funding. The Catalan public administration is actively working to simplify the processing of new [strategic projects](#).



- The year 2022 was also an important year in terms of regulatory deployment in the field of organic waste management and its use as fertilisers. [Law 7/2022](#), of 8 April, on waste and contaminated soil for a circular economy, reinforced the mandatory separate collection of municipal organic fraction, and established new criteria for the recovery of WWTP sludge in agriculture. Meanwhile, [Royal Decree-Law 1051/2022](#), of 29 December, promotes the responsible use of organic fertilisers, such as digestate and organic waste compost, to ensure sustainable management of nutrients in agricultural soils and minimise environmental impact. Finally, on 16 July 2022, [Regulation \(UE\) 2019/1009](#), which establishes the provisions relating to the marketing of fertiliser products in the European Union, placing special emphasis on those of organic origin.

Although these regulatory frameworks share objectives of sustainability and efficiency in the management and recovery of organic waste, some areas have been identified that require greater harmonisation to avoid discrepancies and simplify their application. In order to have a direct impact on this evolving regulatory framework, late 2024 saw the creation of the [Catalan Nutrient Platform](#). In addition to livestock farmers and farmers, this platform also includes representatives of the industries involved (technology suppliers and fertiliser producers), leading research centres in this field, associations and the public administration.

¹¹ ACCIÓ - Agency for Business Competitiveness..

¹² Institute for Diversification and Energy Saving (IDAE).



Pioneering biorefineries

During the years 2022-2024, the first major advances have been made in the conversion of conventional livestock manure treatment plants towards designs that fit into the biorefinery concept. Anaerobic digestion plays a fundamental role in the integration of systems for the valorisation of livestock manure and other agri-food waste in advanced and multifunctional facilities, designed to convert a wide range of high-added-value bioproducts.

One pioneering example is the composting plant operated by [Alcarràs Bioproducers](#), which has undergone significant evolution in recent years, going from a cooperative management facility focused exclusively on manure composting to becoming a true bio-industrial park that, once completed, will integrate several complementary processing lines to the composting and anaerobic

co-digestion lines for slurry and other organic waste, currently in operation. Future projects at this facility include the generation of biochar through pyrolysis processes of plant residues, to improve soil fertility and carbon sequestration, and the production of insects for the conversion of organic waste into high-value protein for the agri-food industry.

4.2.3 Opportunities

The valorisation of livestock manure and organic waste represents a key opportunity to move towards a more sustainable circular bioeconomy model in Catalonia. Among the main opportunities is the possibility of transforming an environmental problem into an economic and beneficial solution in environmental terms. The generation of bioproducts such as quality organic-based fertilisers and biogas/biomethane, among other benefits, allows the replacement of similar non-renewable products essential for the Catalan economy, the availability of which is subject to the volatility of geopolitical and economic factors.

However, several challenges have also been identified that need to be addressed to achieve optimal development of the sector. One of the main obstacles is a regulatory framework that is not always adapted to the principles of the circular bioeconomy, and the regulatory and administrative complexity associated with the implementation of new processing plants, which often entails lengthy processes and high costs. The economic viability of the facilities remains a challenge, as the initial investment required is significant and long-term profitability depends on factors such as the price of energy and available incentives. In addition, the lack of adequate infrastructure, such as biogas distribution networks and efficient transport systems for digestate, can make it difficult to implement new plants in rural areas.

The main barrier, however, is social perception and resistance to change by livestock farmers and local communities. Often, the lack of information about the environmental and economic benefits of sewage treatment generates opposition to projects, which can slow down their implementation. It is essential to carry out awareness campaigns and promote knowledge transfer to foster social acceptance of these sustainable solutions.

It is also necessary to anticipate the appearance of possible problems as a result of having success in increasing the valorisation of

livestock manure and organic waste. The market for these products could undergo distortions due to the increase in demand for biogas/biomethane production, which could cause an increase in prices and generate situations of speculation. This could lead to a concentration of economic benefits in a few companies, excluding small producers and cooperatives. To avoid this, it is necessary to promote a decentralised and equitable management model that ensures a fair distribution of resources and the benefits generated.

In addition to the regulatory, technological and socio-economic barriers mentioned above, biorefineries face the risks of being first-movers (pioneer disadvantage). These additional challenges are associated with the variability of the raw materials themselves, both in terms of heterogeneity of composition and the distribution of their production in time and space, the presence of contaminants in some waste, and the difficulty of commercialising bioproducts. There are also shortcomings in logistics infrastructure, connection

to energy networks and transport costs in rural areas. Competition with other uses of the feedstock, for example in conventional biogas/biomethane plants, may also hinder the growth of the biorefinery sector.

The new 2025-2027 Action Plan aims to increase collaboration between actors in the agricultural, industrial and organic waste management sectors, promoting clear policies, improving technology transfer, developing appropriate infrastructure and, ultimately, promoting projects based on the bioeconomy that add value to the country. For these objectives to materialise effectively, it is essential to adopt a holistic and strategic vision. The implementation of new solutions cannot be fragmented or reactive, but must respond to integrated planning that guarantees long-term sustainability. Only in this way can a circular bioeconomy model be consolidated that transforms current challenges into real opportunities for the territory and society as a whole.



4.3 /

Valorisation
of co-products
and by-products
of the food chain



4.3 / Valorisation of co-products and by-products of the food chain

4.3.1 Description

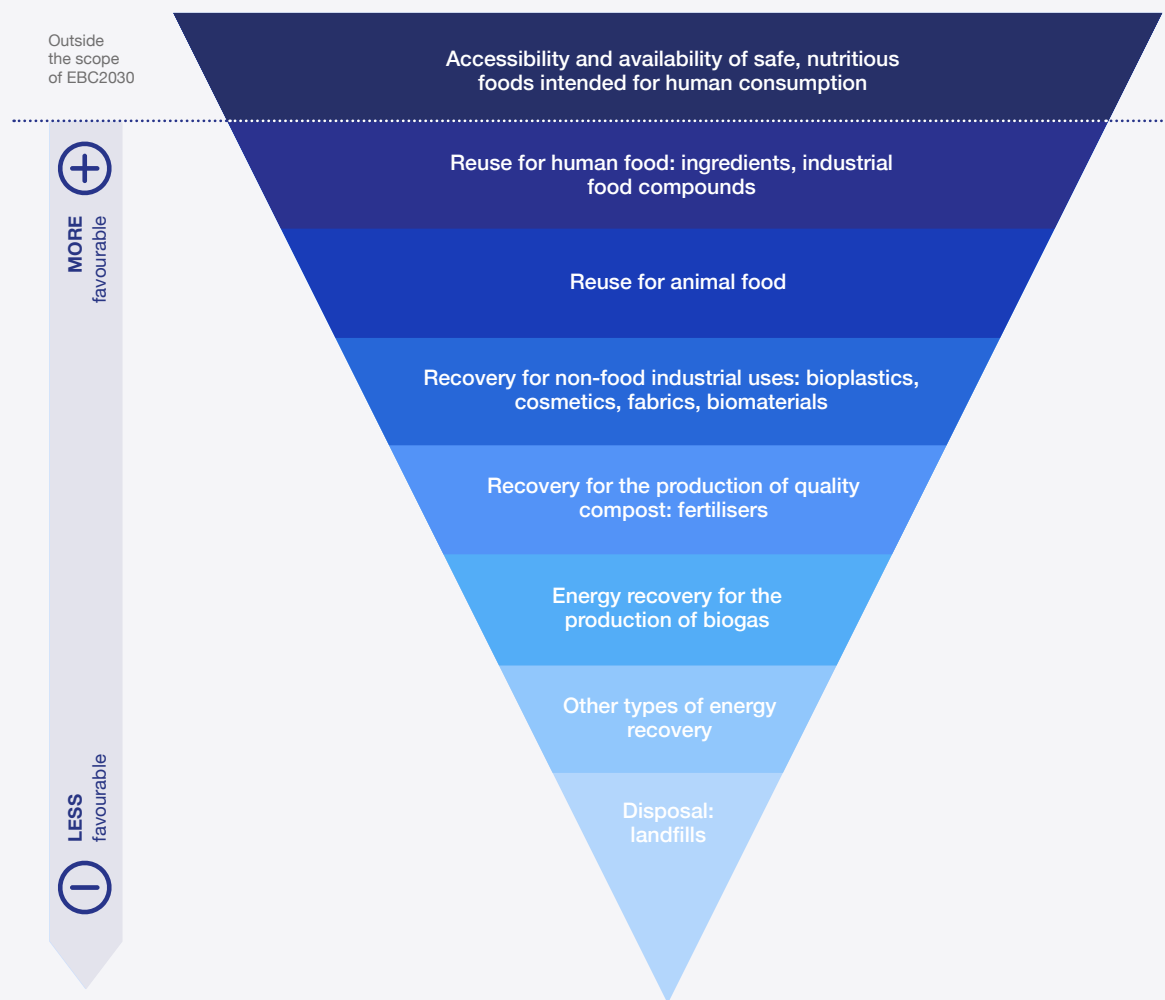
Food loss and waste currently constitute one of the most relevant problems within the global food system, due to its ethical and social implications, and also due to its environmental and economic effects. The waste of resources allocated to food production entails a substantial loss of value, both in terms of raw materials and energy, labour and territory. For this reason, the prevention and reduction of food waste has become a priority within international, state and regional political agendas, as well as a strategic line of action for the transition towards a more sustainable, resilient and efficient food system.

In this regard, Catalonia has been developing a regulatory and strategic framework that articulates public policies aimed at reducing losses and valorising food surpluses. In 2020, [Law 3/2020](#), of 11 March, on the prevention of food losses and waste, a pioneer in Spain and a benchmark on a European scale. This standard establishes the obligation, on the part of economic agents in the food chain, to apply measures to avoid waste, promoting, firstly, its prevention, and secondly, its reintroduction within the value chain according to a hierarchy of priorities. This rule was followed by the publication of [Law 1/2025](#), of 1 April, on the prevention of food losses and waste, of state-level scope and which advances along the same lines.

A fundamental tool within this framework is the hierarchy of uses of food and the by-products that may be derived from it during its

Figure 5
Adaptation of the food use hierarchy.

Source: CREDA-UPC-IRTA and DARP, 2019.



transformation, which establishes the order of priorities in the event that a food product cannot be sold or consumed under the conditions provided for. This hierarchy begins with prevention, continues with direct use for human consumption and transformation for alternative food uses (such as the production of juices, preserves, etc.), continues with its use in animal feed or for the production of non-food compounds with added value, continues with the production of fertilisers and ends with energy uses (such as anaerobic digestion or incineration with energy recovery) or, as a last resort, its disposal in controlled deposits.

The valorisation of food by-products and co-products is based on a new way of understanding the food system, from a circular bioeconomy perspective, where the objective is not only to avoid waste, but to generate new value chains from biomass that was previously wasted. This vision foresees the possibility of transforming surpluses and by-products into new ingredients, functional products, biodegradable materials, organic fertilisers, renewable energy sources or other goods with economic, social and environmental value. The bioeconomy thus becomes a key vector for innovation, business competitiveness and sustainable territorial development.

This approach gives specific space to the valorisation of co-products and by-products of the food chain in instruments such as the Catalan Bioeconomy Strategy 2030 (EBC2030) and the Roadmap for the circular economy of Catalonia 2030 (FRECC) which define a series of actions to promote the transition towards a regenerative economic model, where secondary products and waste become resources and where efficiency in the use of raw materials is key.

4.3.2 Current situation

In the last decade, the Generalitat de Catalunya (Government of Catalonia) has promoted several studies to quantify food losses and waste in Catalonia and the associated economic and environmental impact.

In 2012, the Waste Agency of Catalonia (ARC) published the [Diagnosis of Food Waste in Catalonia](#), where it was highlighted that 262,000 tonnes of solid food were being thrown away annually that could have been used by commerce, restaurants and households. This food was equivalent to an economic expenditure of €841 million and an environmental impact similar to the greenhouse gas emissions generated by 20,300 cars throughout their entire useful life (520,700 t of CO₂-eq, 2010).

DARPA has recently promoted the [Diagnosis of Food Waste in Households in Catalonia](#): quantification, environmental and so-

cioeconomic impact. This analysis, focused exclusively on the domestic sphere, estimates that 173,000 tonnes of solid and liquid food are wasted annually.

The associated economic impact represents an average expenditure of €112 per person per year, which translates into an overall cost of €902.85 million at Catalonia level. In terms of environmental impact, food waste generates 462,347,277 kg of CO₂-eq, derived from the production, distribution and marketing processes of food that was not consumed.

Likewise, since 2019, DARPA has been carrying out studies that quantify food loss and waste in different sectors and links in the food chain, as well as its economic and environmental impact. To do this, it uses the life cycle analysis (LCA) methodology¹³, which is a method of quantitatively assessing the environmental impacts of products, with a whole production chain approach. Below is a summary of the main results.



¹³ https://green-forum.ec.europa.eu/environmental-footprint-methods_en.

Table 4

Lost and wasted food products considering the links defined in the scope of each study, environmental impact associated with three measured categories and equivalences of these data. Year of the study indicated in parentheses.

Source: CREDA-UPC-IRTA and DARP.

PRODUCT	Quantity lost or wasted (tonnes)	Climate Change		Water use			Soil use		
		Emissions (kg CO ₂ -eq)	Equivalence to number of people ¹	Volume (m ³ eq)	Volume (m ³ real)	Equivalence to the number of days of consumption of the Catalan population ²	Pt	Surface (real m ²)	Equivalent to the number of football fields ³
Tomatoes (2020)	16.695	6,94E+06	1.101	4,63E+07	6,17E+05	0,7	1,25E+08	2,54E+06	254
Artichokes (2020)	671	3,64E+05	58	3,31E+07	4,27E+05	0,5	2,81E+07	5,61E+05	56
Apples (2018)	15.258	3,04E+06	483	1,48E+08	1,92E+06	2,0	2,61E+08	5,19E+06	519
Pears (2018)	10.509	2,39E+06	379	1,63E+08	2,10E+06	2,2	2,60E+08	5,16E+06	516
Peaches and nectarines (2017)	31.996	5,17E+06	820	3,86E+08	4,99E+06	5,3	5,60E+08	1,11E+07	1.113
Citrus fruits (oranges and tangerines) (2019)	21.633	4,67E+06	742	3,02E+08	3,91E+06	4,1	4,06E+08	7,96E+06	796
Zucchini (2021)	1.735	8,95E+05	142	1,38E+07	1,80E+05	0,2	2,54E+07	5,02E+05	50
Pork products (2023)	105.074	4,59E+08	72.785	6,20E+08	2,12E+07	22,5	7,62E+09	4,38E+08	43.814
Dairy products (2023)	26.549	3,75E+07	5.954	2,03E+08	3,20E+06	3,4	1,27E+09	2,35E+07	2.351
Total	230.121	5,20E+08	82.464	1,92E+09	3,86E+07	40,9	1,06E+10	4,95E+08	49.469

¹ Estimated based on total CO₂-eq emissions, and the emissions per capita of the Catalan population (IDESCAT 2024, Our World in Data).

² Measured on the basis of real m³, average daily water consumption of the Catalan population of 117 litres per year (Catalan Water Agency).

³ Measured on the basis of real m², surface area of a football field equivalent to 1 ha.

The opportunities for valorisation of secondary flows in the food system, promoted by the bioeconomy, are based on efficient management according to the hierarchy of uses (**Figure 5**).

Firstly, there are initiatives involving free food distribution, which allow the recovery of food still suitable for human consumption and its redistribution through food banks, social entities and support networks. This practice, despite being consolidated, still has room for growth, especially in sectors such as collective catering or large-scale distribution.

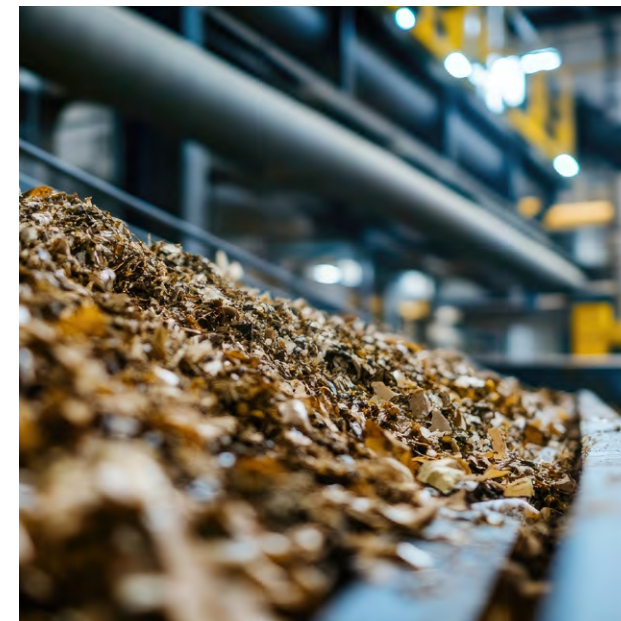
Next, the projects highlighted are: **transformation of food surpluses** into products made from discarded foods such as juices, preserves, jams, creams or healthy snacks. This segment is constantly evolving thanks to the use of pulp, skins and other parts that were previously discarded, valuing their antioxidant, colouring, thickening and nutritional properties as ingredients for new food products. In Catalonia there are already companies specialised in this field, with innovative approaches and a clear orientation towards the circular economy. In this context, the **food utilisation sheets** developed by DARPA and the Institute for Agri-Food Research and Technology (IRTA) offer options and specific examples of the use of these components, with the aim of maximising efficiency in the use of food.

One of the main channels of use is the destination as **animal feed** of both vegetable by-products and processed food products (dairy products, pasta and biscuits), which has been a consolidated practice for some time. In 2022, 126,043 tonnes of plant waste were recovered for this purpose (mainly fruit peel and pulp), 14% more than in 2021, with an economic impact of €12.16 million.¹⁴ In addition to traditional uses in feed for livestock and pets, new avenues are being explored, such as raising insects fed with these by-products, as a future trend in use within the circular bioeconomy.

Another application block refers to the **valorisation of surpluses in non-food uses**. These alternative uses take advantage of elements such as fruit skins, seeds, shells or plant fibres to develop innovative materials with diverse applications in industries such as cosmetics, pharmacy, chemistry, biotechnology or the manufacture of bioplastics. This line also opens up new opportunities for business innovation through biorefineries that extract renewable components through cascading processes equivalent to those used in the fossil fuel industry.

As a last resort option, food surpluses can be used for organic fertiliser production, returning nutrients to the soil and closing the cycle of organic matter. This recovery can be performed directly through composting or after an anaerobic digestion process that allows the generation of **biogas** before using the waste as an agricultural amendment. It is a useful alternative when other uses with more added value are not viable.

Regarding the origin of the products, it can be concluded that the main routes for valorisation of co-products of **plant origin** pass through their transformation into food products or the incorporation of their components into new products, such as snacks, baked goods or soups, taking advantage of their fibre content, antioxidants or functional compounds. Flours for animal feed are also developed from fruit pulps and skins with nutritional and technofunctional properties. Other options include the extraction of high-value-added compounds in biorefineries—such as polyphenols, pectins or aromas—with applications in the food, cosmetic or pharmaceutical industries. In addition, bioconversion with insects, mushrooms or microorganisms is promoted to generate protein-rich biomass. Finally, the resulting waste can be used for fertiliser, composting or biofuel.



On the other hand, the valorisation of co-products of **animal origin** begins with the slaughter and cutting of the carcasses. The processing of viscera, blood, hair, skin, nails, fat and bones allows us to obtain a wide range of products for human and animal food (functional ingredients, collagen, gelatine, protein hydrolysates, etc.) and products for the pharmaceutical industry (insulin, heparin, hormones and enzymes). A growing number of biostimulant products for plants made from animal by-products are also being marketed. It should be noted that the use of animal by-products in human or animal food is restricted due to biosafety issues, according to the conditions imposed by Royal Decree 1528/2012 which establishes the conditions for the application of the EU regulations on SAN-DACH (animal by-products not intended for human consumption).

¹⁴ Source: <https://www.idescat.cat/industria/eip?id=1039300004>.

4.3.3 Opportunities

The valorisation of co-products¹⁵ and food by-products¹⁶ in Catalonia is currently at a watershed. Despite existing barriers—such as lack of knowledge about valorisation routes, lack of financial resources, inadequate regulation, transportation, logistics and storage costs or consumer reluctance to certain uses—the current context presents multiple opportunities that can accelerate this transition.

One of the main levers of change is the drafting of the Strategic Plan for the Prevention of Food Losses and Waste in Catalonia (PEPPMAC). This instrument should allow for the establishment of a clear roadmap, with specific objectives, actions and indicators, to reduce food waste and promote its use in alternative applications. PEPPMAC aims to generate a transversal action framework that integrates all agents in the food chain, reinforces prevention and facilitates innovation to promote food use.

Meanwhile, new business opportunities have been opening for companies, whether those that are already part of the agri-food sector or for new actors specialising in biomass transformation, biotechnology or the development of new products. The rise in demand for sustainable products and the orientation of European funds towards the green economy generate a favourable context for investments in bioeconomy projects.

The advances in research and innovation also represent an outstanding opportunity. Catalan technology centres and universities are developing emerging technologies for the separation and purification of compounds, the fermentation of organic substrates, the



synthesis of biopolymers or the valorisation of liquid waste such as whey. Collaboration between research and business, as well as the promotion of pilot projects, can accelerate technology transfer and facilitate its application on a commercial scale.

Finally, other factors such as evolution of social and environmental awareness, the promotion of green public procurement, sectoral cluster initiatives or Catalonia's adherence to international circular economy networks and sustainable food systems contribute to creating a favourable environment for transformation. This also includes the development of collaborative and territorial models, such



as local communities of use, shared logistics platforms or circular innovation hubs in rural areas.

Overall, Catalonia is facing a window of opportunity to consolidate a more circular, efficient and innovative food economy, taking advantage of the potential of its surpluses and by-products as key resources for a new green and regenerative economy and a more sustainable food system.

¹⁵ The term “food co-product” is used to refer to products that are generated simultaneously or jointly during a main production process.

¹⁶ A “food by-product” is defined as a substance or object resulting from a production process, the primary purpose of which was not the production of that substance or object.

Resilient agrofor-
estry landscapes
and the sustainable
provision of eco-
system services



4 / Resilient agroforestry landscapes and the sustainable provision of ecosystem services

4.4.1 Description

Catalonia is a Mediterranean region with a high diversity of forest and agroforestry landscapes and extensive urban-forest interfaces. Managing forest and agricultural landscapes in an ecologically and socioeconomically sustainable way is becoming, today, a national challenge, especially if we take into account the impacts derived from the climate emergency situation, loss and degradation of habitats and biodiversity, increased energy demand and the supply of food and raw materials.

The co-design of resilient agroforestry landscapes and the sustainable provision of ecosystem services aims to adopt common criteria and objectives that contribute to the socio-ecological resilience of a landscape. At the same time, it integrates the will, knowledge and requirements of local agents to transform the challenge into an opportunity for integrated planning and management of the territory. In order to respond to this context, it is necessary to identify a series of cross-cutting framework actions that give added value to local natural resources, contribute to rural and economic development and preserve ecological capital.

4.4.2 Current situation

In the current context of global change, designing and recovering mosaic agroforestry landscapes that allow for environmental, social



and economic balance and are resilient to the effects of climate change involves exploring and finding practical answers and solutions to:

- Preserve a variety of diverse and healthy ecosystems.
- Conserve and improve soil quality and promote its role as a carbon sink.
- Halt the loss of biodiversity.
- Promote and guarantee food sovereignty.
- Increase the quantity and quality of blue water.
- Promote local circular bioeconomy models.
- Promote generational succession and access to land.

Although the concept of resilient agroforestry landscape is an attractive framework for designing and managing a large part of Catalan landscapes, with great potential to address environmental and socioeconomic changes at a local and global scale, it is currently a challenge to put it into practice. Implementing resistant and resilient landscapes involves taking into account the following aspects:

- Forestry analysis and planning
- Provision of ecosystem services and conservation of biodiversity
- Socioeconomic vector and market
- Governance
- Legal and urban framework
- Risks

4.4.3 Opportunities

Based on the understanding of the resistance and resilience of landscapes, establishing the objectives and premises that are to be achieved together, adopting a multi-criteria planning methodology that integrates the future valuation of multiple ecosystem services and integrating multiple agents and roles of the territory with responsibilities in the decision-making process, the aim is to identify actions and develop technological, environmental, security and socioeconomic solutions in the landscape that contribute to these change processes.

Given the transversal and complex dimension involved in establishing these landscapes, the following approaches should be considered:

- Integration of scientific and technical knowledge using simulation and estimation tools for ecosystem services to define priority management areas to improve the provision of multiple ecosystem services and the promotion of biodiversity.
- Public-private cooperation framework to encourage the establishment of competitive value chains (agricultural and forestry) in the market, through various economic and financial mechanisms: regional and European level aid, improved insurance (for example, fire insurance), payment mechanisms for environmental services, etc.
- Governance processes to promote a good fit between the multiple actors involved: owners, companies, administration, third sector, etc.
- Mechanisms to encourage work and activity in the territory (tax exemption, bonuses, etc.).



First pilot resilient landscape: Soriguera

Within the framework of the 2022-2024 Action Plan, a first pilot project for a resilient agroforestry landscape was co-designed at the same time as a prototype methodology was developed for this purpose. In this exercise, socio-ecological resilience at the landscape scale was understood as the capacity of this landscape to sustainably maintain the provision of its most characteristic ecological, social and economic ecosystem services over time and under changing environmental and socioeconomic conditions.

Thus, the result must be a living, dynamic and diverse landscape in both its ecological and socioeconomic aspects, in which people can develop multiple activities in line with the conservation of nature. The main objective was to develop a management plan to identify the areas and actions that need to be implemented in the territory to increase the resilience of agroforestry landscapes and the provision of ecosystem services, based on four global premises of socio-ecological resilience and a series of technical criteria in specific areas.



These specific resilience premises for Mediterranean agroforestry landscapes are:

- / Reduce the risk of forest fires.
- / Conserve biodiversity.
- / Produce blue water.
- / Promote agricultural and livestock activities.

The co-design of a resilient agroforestry landscape for Soriguera, a municipality in Pallars Sobirà with an area of 106 km², where 75% of the municipality is part of the Alt Pirineu Natural Park and with 71 km² of publicly-owned forests, it was possible to conclude:

- A more heterogeneous landscape mosaic means the maintenance and creation of rich and diverse habitats.
- A quantitative increase in blue water production.

- The decrease in surface fuel load and standing biomass leads to a reduction in the risk of forest fires and the potential to minimise the negative effect of fires on the carbon balance.
- The possibility of promoting agricultural and livestock activity to maintain a living and heterogeneous landscape mosaic in the long term.
- An increase of up to five times in forest mobilisation capacity with the consequent reactivation of the forestry sector, creating jobs and promoting the bioeconomy.
- A high mobilisation of wood destined for long-life products and a positive effect on the associated carbon balance.

The resilient landscape planning exercise has been accompanied by a series of bilateral meetings with technical personnel from the territory in order to agree on the actions that will be developed. 36 actions have been compiled to be implemented with a budget of €1.7 million, which are made up of both already planned projects that have been agreed to be developed within the Resilient Landscapes programme and new actions to be developed. The actions have been divided into four cross-cutting blocks that aim to address most of the problems identified:

- Conservation of natural and cultural heritage and biodiversity
- Management of game fauna
- Forest management
- Promotion of agriculture and livestock

Resilient landscapes in Catalonia

Apart from this first pilot scenario of Soriguera, work is being done on five more definitions of resilient landscapes in Catalonia: Terres de l'Ebre, Camprodon Valley, Carme Valley and Cerdanya (Figure 6). In the latter case, methodologies designed within the framework of RIS3CAT 2030 have been applied.

However, it is expected that an aid order will be approved to extend the Resilient Landscape programme throughout the Catalan territory and thus encourage the dissemination and adoption of this initiative by different communities.

Figure 6
Pilot areas of the EBC2030 Resilient Landscapes programme.

Source: CTFC's own production.





2nd
**ACTION
PLAN**
2025-2027

5. Methodology

5. Methodology /

The following methodology was used to draft the 2025-2027 Action Plan:

- 1. **Compilation and analysis of the starting point:** an analysis has been made of the needs and opportunities of the circular bioeconomy in Catalonia, as well as of trends in the field of bioeconomy in other states and regions.
- 2. **Interviews with key agents:** interviews have been carried out with strategic agents from specific economic sectors and with bioeconomy promoters to identify strengths and gaps in current planning.
- 3. **Participatory workshops:** working sessions have been organised with representatives from the business world, research, administration and civil society to identify priorities and proposals for action.
- 4. **Bilateral interviews with government units:** discussions have been held with the units of the Generalitat involved in the field of bioeconomy to identify the actions planned within the framework of the EBC2030 for the period 2025-2027.
- 5. **Analysis of the proposed actions:** the actions identified have been reviewed to detect overlaps and/or shortcomings in relation to the strategic objectives, strategic lines and measures of the EBC2030, as well as with the four value chains prioritised in the Action Plan.
- 6. **Definition of transformative actions:** Based on the previous analysis and following the criteria of need and opportunity, feasibility of execution and transformative potential to generate systemic changes, transformative actions have been defined.

7. **Institutional validation:** the transformative actions have been validated by the EBC2030 Interdepartmental Commission. .

Below, the different units of the Government of the Generalitat de Catalunya promoting transformative actions are presented.

The Action Plan is a dynamic document that serves as a strategic and operational framework for the deployment and implementa-

tion of actions in the field of circular bioeconomy that the Government of the Generalitat of Catalonia plans to promote during the period 2025-2027. This document guides public policies in this area, facilitates interdepartmental coordination and with territorial agents, and establishes the basis for the monitoring, evaluation and continuous adaptation of transformative actions that contribute to achieving the objectives of the EBC2030.

Table 5
List of the units promoting the 2025-2027 Action Plan.

DARPA	/	Ministry of Agriculture, Livestock, Fisheries and Food
DTER	/	Ministry of Territory, Housing and Ecological Transition
ACA	/	Catalan Water Agency
ARC	/	Catalan Waste Agency
ICAEN	/	Catalan Energy Institute
INCASÒL	/	Catalan Soil Institute
FGC	/	Railways of the Government of Catalonia
DEMT	/	Department of Business and Labor
ACCIÓ	/	Agency for Business Competitiveness
DEF	/	Department of Business and Finance
DREU	/	Department of Research and Universities





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6. Actions

6. Actions /

Below are detailed the **10 shares** in a tab format that includes the following fields:

Strategic objectives: strategic objectives of the EBC2030.

Strategic lines: strategic lines of the EBC2030.

Measures: EBC2030 measures.

Description: generic description of the transformative action and details of the different actions that will be developed.

Major milestones: EBC2030 milestones to which it contributes.

Promoting units: units responsible for developing and implementing the action.

Value chains: value chains that drive transformative action.

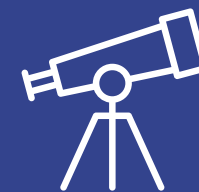
Sources of financing: sources of funding for the development and implementation of transformative action.

Budget: budget for the development and implementation of the transformative action.

Indicators: monitoring indicators for the development and implementation of transformative action.



Bioeconomy Observatory



Strategic objectives

- O1.** Improve the use of Catalonia's biomass through characterisation, quantification, optimisation of management and distribution.

Strategic lines

- O1.L1** Have biomass data in a format that provides added value to users.

Measures

- M1.** Integrate and complete existing data related to the bioeconomy in an observatory.
- M2.** Integrate digitalisation systems and advanced data use.

Major milestones

- F1.** Increase the weight of the bioeconomy in Catalonia's GVA by up to 5%.
- F5.** Increase the utilisation of forest resources by 30%.
- F6.** Increase by 40% the use and valorisation of co-products and by-products of the agri-food chain.

Description

The objective is to provide information and generate knowledge about available biomass, its access and the main bioeconomy indicators. The aim is to offer data with transparency and accessibility to facilitate decision-making by the agents involved and to monitor the actions taken.

Among the actions planned, the following stand out:

1.1 Deploy and consolidate the Agro-Food, Rural and Environmental Observatory. This data valuation and digitalisation system in the fields of agriculture, livestock, forestry, fishing, the food industry, the rural world and the environment, it facilitates the analysis of the primary sector and the bioeconomy in an efficient and innovative way. It has a business intelligence system that allows you to generate interactive visualisations and download data with consistency and transparency. After its construction, its use in decision-making will be promoted.

1.2 Measuring and monitoring the economic impact of the bioeconomy in Catalonia based on methodologies and indicators harmonised with those of the European Union.

1.3 Collaborate with "Circular Catalonia: the Circular Economy Observatory". This tool promoted by the DTER gives visibility to Catalonia's advances in the green and circular economy. Work will be done in a coordinated manner to integrate bioeconomy content and to guarantee coherence between circularity policies.

Promotional units	DARPA, DTER, ACA, ARC, ICAEN
Value chains	Cross-cutting
Sources of funding	DARPA Fund
Budget	€1.5 million
Monitoring indicators	- Number of visits and data downloaded to the Observatory - Evolution of production, GVA and employment in the bioeconomy; number of published reports; number of document downloads - Number of collaborations with Catalunya Circular

Boosting industrial activity in the bioeconomy



Strategic objectives

- O2.** Develop a business network based on the circular bioeconomy throughout the territory, paying special attention to the primary sector.

Strategic lines

- O2.L1** Promote joint work between companies throughout the value chain to attract supply and demand.
- O2.L2** Strengthen the growth of existing bioeconomy-based businesses.
- O2.L3** Encourage the creation of new companies and business models based on the bioeconomy.

Measures

- M5.** Improve the management and distribution of biomass.
- M6.** Develop the Bioeconomy Hub based on existing infrastructure elements.
- M7.** Encourage the creation of industrial symbiosis initiatives.
- M8.** Identify and inventory the value chains, the necessary technology and the potential market for bioproducts, biomaterials and bioenergy by georeferencing producers, logistics operators, technology companies and end consumers.
- M9.** Promote lines of aid and financing for investments and developments in the bioeconomy
- M10.** Promote the development of feasibility studies (economic, social and environmental) and business models.
- M11.** Promote aid and financing lines for newly created companies in the bioeconomy.
- M12.** Promote the transfer of spaces for the implementation of businesses.

Description

The purpose is to provide tools that favour the development of industrial activity in Catalonia in the bioeconomy sector.

Among the actions that will be carried out are:

- 2.1 Strengthen BioHubCat's business and entrepreneurship support service.** The service will focus on connecting public and private infrastructures, capacities and services, overcoming barriers to their implementation and promoting innovation initiatives.
- 2.2 Support the development of three bio-industrial parks** to group companies, research centres and other agents involved in the bioeconomy in the territory. They must help promote the valorisation of local resources and sustainable technologies and solutions based on symbiosis, collaboration and the creation of synergies between actors.
- 2.3 Develop a processing guide for the implementation of bioindustries aimed at local administrations** to establish a clear, transparent and efficient framework and reduce administrative barriers for the implementation of bioindustries.
- 2.4 Promote bioeconomy projects in ACCIÓ's Green Innovation Program** which encompasses ACCIÓ services, grants and activities to position sustainability as a strategic pillar of the company through innovation and technology.
- 2.5 Promote new business models based on the bioeconomy** with access to financing, advice and infrastructure for emerging companies committed to the bioeconomy.
- 2.6 Promote the use of bio-based raw materials in hybrid sectors to spur their use from industrial demand,** reduce dependence on fossil resources and contribute to decarbonisation and the circular economy.

Promotional units	DARPA, BioHubCat, ACCIÓ, DTER, ARC, INCASÒL
Value chains	Cross-cutting
Sources of funding	DARPA Funds, ARC Funds
Budget	€11.3 million
Monitoring indicators	- Number of consulting services - Number of biopolygons created - Number of downloads and presentations of the guide - Number of bioindustries implemented - Number of collaborations with the hybrid sector

Major milestones

- F1.** Increase the weight of the bioeconomy in Catalonia's GVA by up to 5%.
- F2.** Increase jobs in the primary sector by 10%. Increase the incorporation of young people into the rural and maritime world by 15%.
- F3.** Achieve that 30% of newly created businesses in the agri-food sector are based on the circular bioeconomy.

Industrial scale-up plants: technology transfer from the laboratory to industry



Strategic objectives

O5. Position knowledge as a driver of the circular bioeconomy.

Strategic lines

O5.L1 Promote research, innovation and technology transfer linked to the bioeconomy.

O5.L2 Promote the transfer and exchange of knowledge.

Measures

M24. Promote projects that allow the pre-industrial and industrial scaling of new products and services.

M25. Promote technological improvements and technology-based companies, start-ups, spin-offs and scale-ups linked to the bioeconomy.

M26. Encourage companies to promote innovation and research projects in the bioeconomy.

M27. Incorporate companies into collaborative spaces for creativity and experimentation processes.

M29. Promote bioeconomy advice along the value chain.

Description

Industrial pre-scaling plants are crucial in the bioeconomy. They allow processes and technologies to be validated and optimised before large-scale production. They offer a space to experiment with machinery, materials and products, facilitating the transition from research to commercial production. This helps reduce risks, costs and time, ensuring that innovations are viable and efficient.

Among the plants that will be promoted are:

3.1 Catalonia Forestry Hub (CTFC). It will offer innovation and technology services to enhance local wood. The facilities include: a pre-industrial testing laboratory for construction with wood, carpentry and joinery; a prototyping plant, and green chemistry and aromatic plant laboratories to promote mycology and other non-timber forest products. It will promote collaboration between research, management, social enterprise and citizens to promote sustainable forest management and the revitalisation of the sector.

3.2 Network of centres to scale up alternative protein production (IRTA). Several centres will work in a network to produce alternative proteins. The project covers the entire value chain, from biomass production to the development of reformulated food products.

3.3 Scaling up algae production (IRTA). Based on pilot tests and European projects, work is being done to transfer cultivation systems to a pre-industrial scale, promoting efficient, sustainable production aligned with the principles of the blue economy. It includes advice to companies and technology transfer to facilitate the commercial implementation of innovative practices.

Promotional units

DARPA, CTFC, IRTA

Value chains

Improvement of forest management and the utilisation of forest resources
Valorisation of co-products and by-products of the food chain

Sources of funding

DARPA, ERDF funds

Budget

€12.7 million

Monitoring indicators

- Number of projects promoted
- Number of services to companies and other external agents

Major milestones

- F1.** Increase the weight of the bioeconomy in Catalonia's GVA by up to 5%.
- F4.** Increase the number of start-ups by 20% and scale-ups in the field of bioeconomy. Increase by 10% the number of companies developing technologies in the field of bioeconomy.

Research and innovation



Strategic objectives

- O5.** Position knowledge as a driver of the circular bioeconomy.

Strategic lines

- O5.L1** Promote research, innovation and technology transfer linked to the bioeconomy.
- O5.L2** Promote the transfer and exchange of knowledge.

Measures

- M23.** Identify the main challenges and solutions and promote research, innovation or/transfer projects linked to the bioeconomy.
- M26.** Encourage companies to promote innovation and research projects in the bioeconomy.
- M27.** Incorporate companies into collaborative spaces for creativity and experimentation processes.
- M29.** Promote bioeconomy advice along the value chain.

Major milestones

- F4.** Increase the number of start-ups by 20% and scale-ups in the field of bioeconomy.
Increase by 10% the number of companies developing technologies in the field of bioeconomy.

Description

The purpose is to promote research and innovation to promote the bioeconomy, both from research centres and companies. The aim is to connect knowledge, optimise efforts and guide research, innovation and technology transfer towards the identified challenges.

Among the actions planned, the following stand out:

- 4.1 Promote RDI in bioeconomy in centres affiliated with DARPA** based on the collaborative and interdisciplinary identification of challenges and solutions.
- 4.2 Create a network of bioeconomy living labs** to promote co-creation and open innovation.
- 4.3 Disseminate knowledge and facilitate technology transfer** with the constitution of an RDI network in bioeconomy, demonstration activities financed with EAFRD funds and other similar instruments.
- 4.4 Promote RDI in bioeconomy in companies** through RDI programmes and subsidy lines. It includes the operational groups and lines of ACCIÓ's Green R&D Nuclei.
- 4.5 Promote research into innovative livestock manure treatment systems and boost the organic fertiliser value chain** to enhance local resources with new production systems and by-products from farms which, at the same time, contribute to climate change mitigation and adaptation.
- 4.6 Include bioeconomy challenges in the call for Regions of Knowledge and in the actions of the RIS3CAT Opportunity Discovery Mechanism** within the framework of resilient agroforestry landscapes, the circular bioeconomy, the improvement of soil quality and its sink capacity and the wood value chain.

Promotional units DARPA, ACTION, DTER, ARC, DEH, DREU, universities

Value chains Cross-cutting

Sources of funding DARPA Fund, ARC Fund, EAFRD, ERDF, Climate Fund

Budget €31.9 million

Monitoring indicators

- Number of bioeconomy projects promoted
- Number of published scientific bioeconomy papers
- Number of bioeconomy living labs promoted
- Number of agents involved
- Number of transfer activities funded
- Weight of organic fertilisers used
- Number of projects promoted

Access and management of forest biomass



Strategic objectives

- O1.** Improve the use of Catalonia's biomass through characterisation, quantification, optimisation of management and distribution.
- O2.** Develop a business network based on the circular bioeconomy throughout the territory, paying special attention to the primary sector. .

Strategic lines

- O1.L2** Ensure sustainability and efficiency in the management and distribution of biomass.
- O2.L2** Strengthen the growth of existing bioeconomy-based businesses.

Measures

- M3.** Facilitate the availability and quality of biomass.
- M5.** Improve the management and distribution of biomass.
- M9.** Promote lines of aid and financing for investments and developments in the bioeconomy.

Major milestones

- F2.** Increase jobs in the primary sector by 10%.
Increase the incorporation of young people into the rural and maritime world by 15%.
- F4.** Increase the number of start-ups by 20% and scale-ups in the field of bioeconomy.
Increase by 10% the number of companies developing technologies in the field of bioeconomy.
- F5.** Increase the utilisation of forest resources by 30%.

Description

The objective is to promote improved access, management and distribution of forest biomass to boost economic activity linked to the forestry sector, encourage the creation of jobs in the territory and promote efficient and sustainable use of natural resources.

Among the main actions that will be carried out are:

5.1 Draw up and implement the 2025-2035 General Forestry Policy Plan which aims to increase the forest area managed for adaptation to climate change, fire prevention, the provision of blue water and the development of the bioeconomy.

5.2 Facilitate sustainable forest management on publicly and privately owned farms. Through the call for grants, the drafting and revision of forest management instruments, the adaptation of the road network for forest management, sustainable forest management, silvicultural actions to improve and generate ecosystem cycles, the prevention of forest fires and the restoration of forest potential will be promoted.

5.3 Promote the business fabric linked to local forestry use. Initiatives and collaborations will be promoted that favour the creation and consolidation of companies and the creation of jobs in the territory linked to the management and sustainable use of local forest resources.

Promotional units	DARPA, CPF
Value chains	Improvement of forest management and the utilisation of forest resources
Sources of funding	DARPA Funds, CPF Funds, EAFRD
Budget	€45 million
Monitoring indicators	- Degree of implementation of the General Forestry Policy Plan - Number of hectares managed - Volume of use of local forest resources

Valorisation of livestock manure and other organic waste



Strategic objectives

- O1.** Improve the use of Catalonia's biomass through characterisation, quantification, optimisation of management and distribution.
- O2.** Develop a business network based on the circular bioeconomy throughout the territory, paying special attention to the primary sector.

Strategic lines

- O1.L2** Ensure sustainability and efficiency in the management and distribution of biomass.
- O2.L2** Strengthen the growth of existing bioeconomy-based businesses.

Measures

- M3.** Facilitate the availability and quality of biomass.
- M4.** Prioritise the local valorisation of organic matter and by-products.
- M5.** Improve the management and distribution of biomass.
- M9.** Promote lines of aid and financing for investments and developments in the bioeconomy.

Major milestones

- F1.** Increase the weight of the bioeconomy in Catalonia's GVA by up to 5%.
- F8.** Reduce emissions linked to the management of livestock manure and food waste by 30%.
- F9.** Increase the use of renewable fuels in the primary sector by 100%.

Description

The purpose is to improve the quality of the biomass obtained and optimise its material and energy use through processes with greater added value.

The following actions are planned:

6.1 Promote the installation of biogas plants and treatment of organic material obtained in anaerobic digestion, biogas purification and infrastructure elements and other facilities necessary for the injection of biomethane into the gas pipeline network. to reduce greenhouse gas emissions and improve organic waste management, within the framework of the 2024-2030 Catalan Biogas Strategy.

6.2 Implement the Catalan Digestate Strategy 2030 for the sustainable management of digestate from anaerobic digestion of organic materials and waste, its valorisation as value-added bioproducts and the promotion of the market for its distribution.

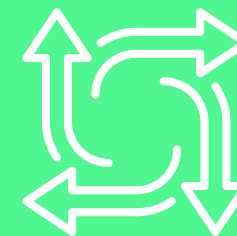
6.3 Increase the quantity and quality of the selective collection of the organic fraction of municipal waste through a line of subsidies intended for local entities and businesses and services producing organic waste in Catalonia.

6.4 Increase the biological treatment capacity of the organic fraction of selectively collected municipal waste with the necessary investments according to the Sectoral Territorial Plan for Municipal Waste Management Infrastructures of Catalonia and the Implementing Decision (EU) 2018/1147 of the European Commission.

6.5 Promote the Roadmap for the Management of Wastewater Treatment Plant Sludge in Catalonia (2025–2035) with investments for the use of wastewater treatment sludge through anaerobic digestion to produce biogas and fertilisers.

Promotional units	DARPA, DTER, ACA, ARC, ICAEN
Value chains	Valorisation of livestock manure and other organic waste
Sources of funding	DARPA Fund, DTER Fund, ARC Fund, ACA Fund
Budget	€137.5 million
Monitoring indicators	- Annual biogas generation and annual biogas generation from WWTP sludge - Number of biogas plants in operation - Biomethane injected into the network - Quantity of digestate produced - Quantity of nutrients valued in the digestate produced - Volume of water recovered from the digestate produced - Weight of organic fraction collected selectively - Improper parts in the selectively collected organic fraction - Weight of selectively collected and treated organic fraction - Capacity to treat the selectively collected organic fraction - Weight of WWTP sludge generated and treated

Valorisation of co-products and by-products of the food chain



Strategic objectives

- O1.** Improve the use of Catalonia's biomass through characterisation, quantification, optimisation of management and distribution.
- O2.** Develop a business network based on the circular bioeconomy throughout the territory, paying special attention to the primary sector.

Strategic lines

- O1.L2** Ensure sustainability and efficiency in the management and distribution of biomass.
- O2.L2** Strengthen the growth of existing bioeconomy-based businesses.

Measures

- M3.** Facilitate the availability and quality of biomass.
- M5.** Prioritise the local valorisation of organic matter and by-products.
- M9.** Promote lines of aid and financing for investments and developments in the bioeconomy.

Major milestones

- F3.** Achieve that 30% of newly created businesses in the agri-food sector are based on the circular bioeconomy.
- F6.** Increase by 40% the use and valorisation of co-products and by-products of the agri-food chain.

Description

The valorisation of co-products generated throughout the food chain is key in the circular bioeconomy. Following the hierarchy of use, it is necessary to prioritise prevention, reuse and use for human and animal food, ahead of other uses such as composting or energy production. The objective is to reduce the environmental impact, optimise available resources and open up new opportunities for economic activity.

Among the actions that will be carried out are:

7.1 Develop and implement the Strategic Plan for the prevention of food loss and waste in Catalonia. In order to strengthen prevention and promote the use of unused food flows, the aim is to establish a roadmap that is participated in and agreed upon together with the Catalan agri-food ecosystem, responding to Law 3/2020, on the prevention of food loss and waste, and to the Food Strategy of Catalonia 2025-2030.

7.2 Promote and disseminate good practices for the use of co-products in food value chains through sectoral studies and diagnoses, dissemination conferences and actions to promote the circular economy in the different food sectors.

7.3 Promote the business fabric linked to the valorisation of co-products of the food chain with projects and alliances that promote the generation of economic activity and local employment through the valorisation of food co-products.

Promotional units	DARPA, ARC
Value chains	Valorisation of co-products and by-products of the food chain
Sources of funding	DARPA Fund, Nuclear Transition Fund
Budget	€4.1 million
Monitoring indicators	- Generation of food losses and waste in Catalonia - Number of utilisation initiatives - Number of business initiatives

Resilient agroforestry landscapes and valuation of ecosystem services



Strategic objectives

- O4.** Promote resilient agroforestry landscapes and the sustainable provision of ecosystem services in the context of the Catalan circular bioeconomy.

Strategic lines

- O4.L1** Promote the establishment of resilient agroforestry landscapes based on advanced tools and expert knowledge.
- O4.L2** Conserve and improve the quality of agricultural soils and promote their role as carbon sinks.
- O4.L3** Promote the provision of ecosystem services.

Measures

- M17.** Commit to territorial management that promotes resilient landscapes and the definition of priority areas for their establishment.
- M18.** Promote the creation of new economic activities that facilitate the management of resilient landscapes.
- M19.** Promote organic fertilisation in agricultural soils.
- M20.** Implement agronomic practices that increase soil quality.
- M21.** Identify and promote ecosystem services in the context of the Catalan bioeconomy.
- M22.** Establish payment mechanisms for environmental services that favour territorial management and facilitate the social and economic viability of the territory.

Description

The purpose is to promote sustainable management of the territory to strengthen its climate and ecological resilience and for this management to have economic benefits in rural areas, also promoting social resilience.

Among the actions planned, the following stand out:

- 8.1 Deploy the Resilient Agroforestry Landscapes programme** with the execution of pilot projects, the promotion of a line of aid that scales the programme in the territory and support tools to execute the necessary actions.
- 8.2 Execute the Soil Carbon project and apply carbon agriculture eco-regimes.** Systematise and transfer scientific knowledge on soil health and carbon agriculture generated by research centres to convert it into public policies and agroforestry practices that promote soil quality and carbon capture.
- 8.3 Develop the Climate Credit System of Catalonia.** Launch the information system for managing the purchase and sale of climate credits generated from forest management, carbon agriculture and ecosystem restoration in Catalonia.
- 8.4 Recover and restore degraded marine habitats or ecosystems and quantify marine ecosystem services** within the framework of the Maritime Strategy of Catalonia 2030.
- 8.5 Increase the natural capital of ski and mountain resorts** with the NERET project to improve the ecological and business resilience of mountain resorts managed by FGC-Tourism through solutions based on nature and climate change adaptation and mitigation.

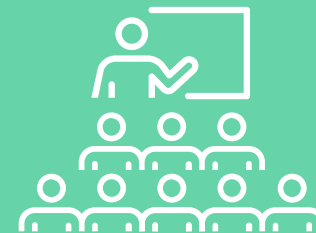
Promotional units	DARPA, DTER, ARC, FGC
Value chains	Resilient agroforestry landscapes and the sustainable provision of ecosystem services
Sources of funding	DARPA Fund, CPF Fund, FGC Fund, FEADER, FEDER, Climate Fund
Budget	€22.7 million
Monitoring indicators	- Number of resilient landscape projects promoted - Surface area of territories within resilient landscapes - Population evolution in these territories - Agricultural area with sustainable agronomic practices - Number of climate credits traded - Territorial surface area in climate credits traded - Number of recovery projects promoted and number of habitats recovered

Major milestones

- F1.** Increase the weight of the bioeconomy in Catalonia's GVA by up to 5%.
- F2.** Increase jobs in the primary sector by 10%.
Increase the incorporation of young people into the rural and maritime world by 15%.
- F7.** Prevent the loss of agricultural land and recover the management of at least 10% of agricultural areas abandoned in the last 30 years.
- F8.** Reduce emissions linked to the management of livestock manure and food waste by 30%
- F9.** Increase the use of renewable fuels in the primary sector by 100%.
- F10.** Increase organic carbon in agricultural soils in Catalonia by 0.4% annually.



Promotion of training, employment and citizen participation in the bioeconomy



Strategic objectives

- O3.** Promote the use and consumption of bioproducts, bioenergy and biomaterials in the market.
- O5.** Position knowledge as a driver of the circular bioeconomy.
- O7.** Prepare Catalan society for the change towards the circular bioeconomy.

Strategic lines

- O3.L2** Improve the positioning of bioproducts, biomaterials and bioenergy in the market.
- O5.L3** Have trained professionals and attract talent.
- O7.L1** Communicate to citizens the need for implementation and the benefits of the bioeconomy, and raise awareness of this matter.
- O7.L2** Incorporate civil society in the design and execution of new projects linked to the bioeconomy.

Measures

- M15.** Promote the sale and differentiation of bioproducts in the market, as well as ensure informed decision-making by consumers.
- M30.** Train existing professionals, develop new professional profiles and promote training projects linked to the bioeconomy.
- M31.** Strengthen the capacity to attract talent in the field of bioeconomy.
- M35.** Promote awareness and dissemination campaigns among citizens to improve their perception of the bioeconomy.
- M36.** Integrate the bioeconomy into educational and training curricula.
- M37.** Design a co-governance system with citizens and other stakeholders.

Description

The purpose is to bring the concept of bioeconomy, its challenges and opportunities closer to society and train professionals to drive its adoption, foster innovation and promote a transition towards more sustainable and circular production models.

Among the actions that will be carried out are:

9.1 Strengthen the presence of the circular bioeconomy in education and training. Introduce bioeconomy content in primary and secondary education and in the Agricultural Schools Programme.

9.2 Promote employment in the bioeconomy in Catalonia. Detect the needs of strategic economic sectors in the bioeconomy and incorporate specific training in professional and continuing education to adapt professional skills to these requirements.

9.3 Communicate the importance and benefits of the bioeconomy and raise awareness about it. To raise awareness of the bioeconomy, its challenges and opportunities through awareness campaigns, the Bioeconomy, Innovation and Technology Congress (BIT), the Annual Conference of the ERIAFF Network and the generation of content within the Virtual Bioeconomy Office in Ruralcat and the #CatalunyaCircular Newsletter.

9.4 Promote the participation of society in the design and implementation of bioeconomy projects. Promote spaces and mechanisms so that citizens, entities and local actors can express their opinions, collaborate and co-create bioeconomy projects and connect initiatives with the real needs of the territory.

Promotional units	DARPA, DTER, ARC, DENT
Value chains	Cross-cutting
Sources of funding	DARPA Funds, ARC Funds
Budget	€2.2 million
Monitoring indicators	- Number of training initiatives in the field of bioeconomy - Number of bioeconomy training courses created and executed - Green employment indicator in Catalonia - Number of communication initiatives executed - Number of co-creation processes

Major milestones

F2.

Increase jobs in the primary sector by 10%.

Increase the incorporation of young people into the rural and maritime world by 15%.

Office of Bioeconomy, Governance and Territorial Coordination



Strategic objectives

- O3.** Promote the use and consumption of bioproducts, bioenergy and biomaterials in the market.
- O6.** Strengthen the role of the Administration and adapt the regulatory and legal framework in a way that favours the bioeconomy in Catalonia.

Strategic lines

- O3.L1** Generate demand for the use and consumption of bioproducts, biomaterials and bioenergy.
- O6.L1** Adapt the regulatory and legal framework.
- O6.L2** Facilitate the implementation of bioeconomy activities in the territory.

Measures

- M13.** Use tenders and public procurement as a tool to boost the bioeconomy.
- M14.** Promote communication and marketing plans and publicise success stories of bioproducts, biomaterials and bioenergy.
- M32.** Identify and adapt legislation and regulations that may represent a barrier and an opportunity for the development of the bioeconomy in Catalonia.
- M33.** Develop the Bioeconomy Office.
- M34.** Orient and coordinate funding sources (European, state and own) to boost the bioeconomy.

Description

The objective is to coordinate the Government's action in the field of bioeconomy, guaranteeing the coherence and efficiency of actions through administrative and governance instruments.

Among the main actions that will be carried out are:

- 10.1 Simplify administrative procedures to promote the implementation and viability of bioeconomy projects.** Approve and deploy the figure of strategic projects and promote measures to streamline procedures to reduce deadlines, simplify and standardise procedures and facilitate interaction with the different administrations.
- 10.2 Integrating the bioeconomy into public procurement** with the dissemination of the Diagnosis of identification of bioeconomy opportunities in public procurement, the identification of clauses and specific training of staff.
- 10.3 Monitor public policies to promote the bioeconomy** with the monitoring of the action carried out by the Government and the annual publication of the Progress Report of the 2025-2027 Action Plan.
- 10.4 Articulate and strengthen the governance of the bioeconomy in Catalonia,** promoting the involvement of local actors, taking an active part in existing bodies and revitalising the Government's Bioeconomy Commission.
- 10.5 Coordinate the deployment of the EBC2030 with the FRECC.** Ensure coordination and the establishment of synergies in the field of circular bioeconomy to promote circular projects.
- 10.6 Strengthen international relations and Catalonia's positioning as a region driving the bioeconomy** with active participation in regional state and international bioeconomy networks such as the EFI Bioregions Facility and the ERIAFF Network.

Promotional units	DARPA, BioHubCat, DTER, ACA, ARC, ICAEN, ACCIÓ, DEF
Value chains	Cross-cutting
Sources of funding	DARPA funds, Own resources
Budget	€0.3 million
Monitoring indicators	- Average project processing time - Number of contracts with bioeconomy criteria - Degree of execution of the Action Plan - Number of agents involved - Number of joint initiatives - Number of external initiatives with the participation of Catalonia

Major milestones

- F1.** Increase the weight of the bioeconomy in Catalonia's GVA by up to 5%.





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7. Timetable and financing

7. Timetable and financing /

The execution schedule of the Action Plan foresees the deployment of the 10 transformative actions throughout the entire period 2025-2027. These actions are considered to be of broad temporal scope, as they address structural challenges and aim to generate systemic changes in the field of the circular bioeconomy. For this reason, all actions will be launched within the established period and will remain active during the three years of execution of the Plan, with progressive implementation and continuous evaluation of its impact and development.

In the period 2025-2027, an overall budget execution of **€269.1 million**, intended for the development and implementation of transformative actions. This investment comes from various sources of funding, including the own funds of the departments involved, resources from environmental taxes for specific purposes, the Nuclear Transition Fund as an instrument of territorial compensation, as well as different European funds for rural and regional development, agricultural guarantee and research.

Table 6 Financing transformative actions.

TRANSFORMATIVE ACTIONS	PLANNED BUDGET (in € millions)				Sources of funding
	2025	2026	2027	TOTAL	
01. Bioeconomy Observatory	1	0,4	0	1,5	DARPA Fund
02. Boosting industrial activity in the bioeconomy	4,9	4,2	2,2	11,3	DARPA Funds, ARC Funds
03. Industrial scale-up plants: technology transfer from the laboratory to industry	4,3	4,3	4,2	12,7	DARPA, ERDF funds
04. Research and innovation	9,6	12,6	9,6	31,9	DARPA Fund, ARC Fund, EAFRD, ERDF, Climate Fund
05. Access and management of forest biomass	11,6	18,4	15	45	DARPA Funds, CPF Funds, EAFRD
06. Valorisation of livestock manure and other organic waste	48	36,5	53	137,5	DARPA Fund, ARC Fund, ACA Fund
07. Valorisation of co-products and by-products of the food chain	1,9	1,7	0,4	4,1	DARPA Fund, Nuclear Transition Fund
08. Resilient agroforestry landscapes and valuation of ecosystem services	7,9	8	6,8	22,7	DARPA Fund, CPF Fund, FGC Fund, FEAGA, FEADER, FEDER, Climate Fund
09. Promotion of training, employment and citizen participation in the bioeconomy	1	0,8	0,4	2,2	DARPA Funds, ARC Funds
10. Office of Bioeconomy, Governance and Territorial Coordination	0,1	0,1	0,1	0,3	DARPA funds, own resources
TOTAL	90,4	87	91,8	269,1	



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8. Governance and monitoring

8. Governance and monitoring /

The governance model of the Action Plan aligns with the strategic framework of the EBC2030 and is structured to respond to four fundamental objectives that guarantee the correct deployment and implementation of the planned actions:

- 1. Strategic adaptation.** Ensure that the measures and actions developed are in line with the principles and objectives of the EBC2030.
- 2. Institutional coordination.** Guarantee maximum coordination between the different departments of the Government of the Generalitat involved in the implementation of the bioeconomy.
- 3. Participation of agents.** Promote the active involvement of economic, social, territorial and sectoral agents linked to the bioeconomy.
- 4. Operational capacity.** Have the mechanisms and resources necessary to execute the actions foreseen in the Action Plan effectively and efficiently.

The scope of the governance system is based on three areas:

- 1. Institutional monitoring.** The EBC2030 Interdepartmental Commission is the body responsible for overseeing the implementation of the Plan and monitoring and validating it annually through the progress report. It brings together representatives of the competent units in the following areas:

/ Rural agenda
/ Agriculture, livestock, fishing and forestry
/ Nutrition
/ Climate action
/ Water, energy and waste
/ Biodiversity
/ Education
/ Economy
/ Digital policies
/ Mountain policies
/ Company
/ Innovation
/ Research

- 2. Strategic coherence.** The Action Plan is being implemented in coordination with other Government strategies and plans related to the bioeconomy and sustainability. This alignment guarantees synergies and avoids overlaps in public planning.

- 3. Territorial and sectoral dialogue.** Constant dialogue is maintained with territorial and sectoral agents, with the aim of strengthening the link between the Plan and the reality of the territory and the dynamics of the sectors involved. This participation contributes to adapting transformative actions to local and sectoral needs and strengthening their impact.

This governance system allows for integrated, participatory and efficient management of the Action Plan, and ensures constant monitoring aimed at achieving the strategic objectives of the EBC2030.







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