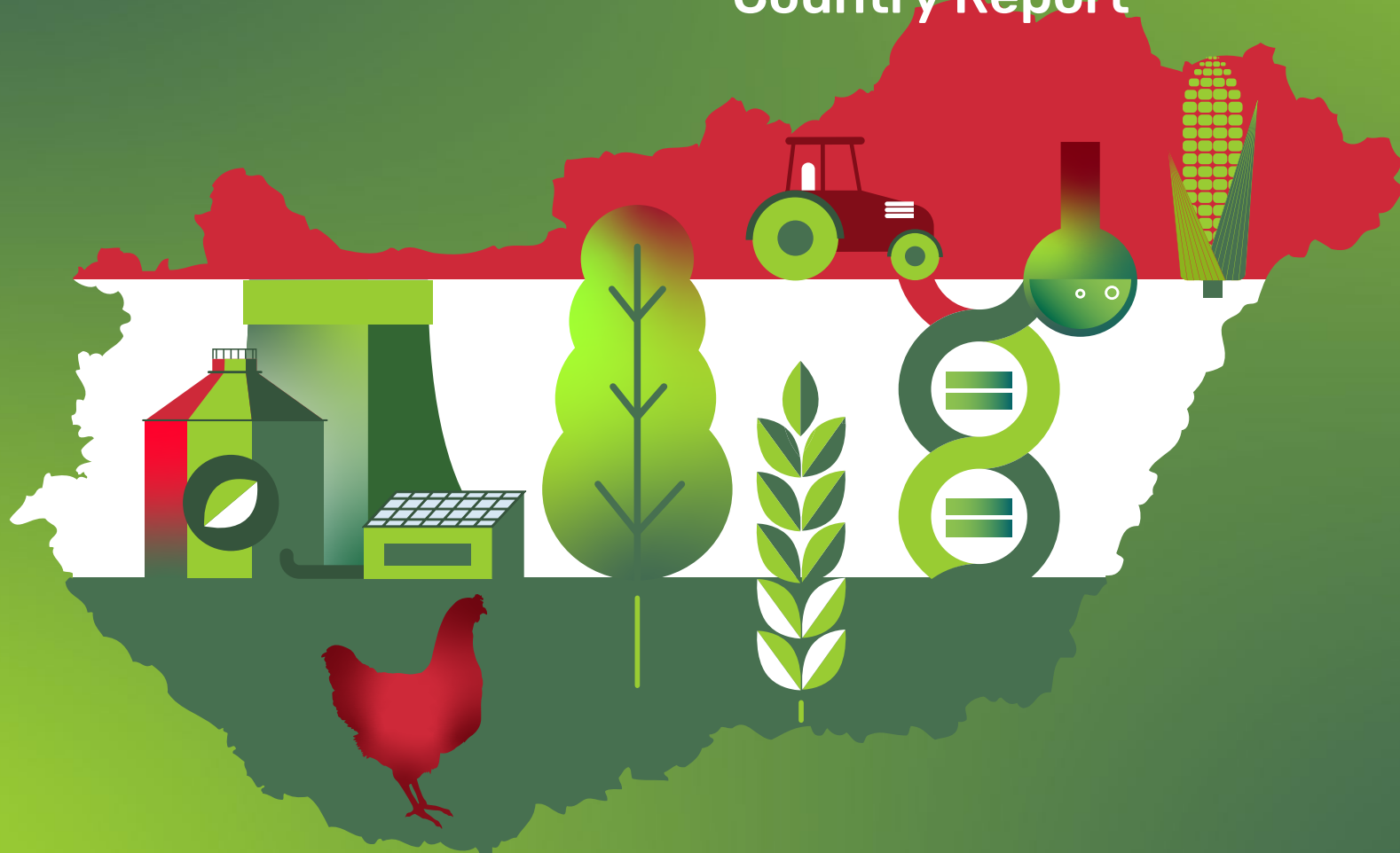


Mapping Hungary's bio-based potential

Country Report





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1.

EXECUTIVE SUMMARY



In 2020, Hungary's bioeconomy was worth €9.6 billion, employing more than 374,500 people across different sectors (data JRC, BioReg EU). The whole sector has huge potential for further expansion and diversification.

Agriculture is the cornerstone of this sector, with over five million hectares of arable land, making up 55% of the national territory and supporting the rural population. The sector's diversity spans major crops—such as maize, wheat, sunflower and rapeseed—and livestock, primarily poultry and pork, which contribute significantly to Hungary's exports. The majority of farms are small in size. There are around 200,000 farms, 30% of which operate under 5 hectares. Despite challenges posed by climate change, decrease in population, necessity of upskilling and a notable trend of rural-to-urban migration (especially from young people), Hungary's agricultural sector holds several strengths and opportunities that can drive further growth.

Hungary's forestry sector covers approximately two million hectares (23% of national territory), with both ecological and economic importance. Deciduous species dominate, particularly black locust and oak, which serve wood-based industries and rural economies. Nearly half of the forests are being protected; the remaining part is valorised for roundwood harvesting, the majority (53.6 %) being used for fuelwood while 18.2% for sawlogs and veneer logs and 16.8% for pulpwood.

Manufacturing of food and beverage contributes considerably to Hungary's economy, with SMEs contributing to approximately 50% of the net turnover of the sector.

Hungary's biotech industry is a growing sector, playing a key role in the country's economy, supported by a strong tradition in pharmaceutical research and manufacturing. Agriculture biotechnology, food biotechnology, and environmental biotechnology are also growing and promising sectors – although not as large as the pharmaceutical and medical biotech industries.

The potential for biorefineries – where agricultural and forestry biomass can be converted into added-value bio-based products – exists but is largely untapped. Existing biorefineries mainly focus on producing biofuels. However, a few biorefineries with a focus on the production of sustainable bio-based products are emerging in Hungary.

While a dedicated national bioeconomy strategy is being developed, different existing strategies and action plans both at national and regional levels are



relevant to the bioeconomy sector, highlighting policy support for the contribution that the whole bioeconomy sector can provide for achieving specific targets in terms of decarbonisation/defossilisation; increased competitiveness and socio-economic growth; strategic autonomy; and resilience. Towards this direction, the BIOEAST initiative is strategic for shaping the future of the bioeconomy in Hungary and beyond.

Considering the high vocation of the country in agriculture and food production, a significant amount of residual biomass from agri-food industries, agricultural crops cultivation and forest-based value chains is available for potential further valorisation into bio-based value chains (more than 9,000 kton d.m. /year). Additionally, only 16% out of 2.3 million tonnes of food and garden bio-waste are currently separately collected and mainly valorised into compost production. Marginal lands mainly focused on the Central-Eastern corridor could be also valorised with an eye towards future biorefineries, establishing a win-win cooperation model between farmers and industries, providing additional sources of income to the primary sector, while contributing to soil regeneration and an increase in green jobs.

According to the **European Innovation Scoreboard**, Hungary belongs to the group of 'Moderate Innovators' in 2024, with a performance of 70.5%. Compared to the EU average, Hungary has lower per capita income but

a faster growing economy with a high share of non-innovators with the potential to innovate.

Hungary presents a fertile ecosystem of universities and research centres working on different aspects of the bio-based economy. However, their involvement in EU bioeconomy projects can further grow in cooperation also with industries. In fact, Hungary is a modest actor with reference to participation in co-funded projects under H2020 and Horizon Europe programmes. Some 252 bioeconomy related projects have been funded with a net EU contribution of €63.9 million.

The CBE-JU programme, Just Transition Fund, Innovation Fund and European Circular Bioeconomy Fund are valuable instruments which could be better valorised by Hungary in a synergistic way to financially support the deployment of demo and full scale flagship biorefineries and related value chains.

This document is part of the 'strategic outreach programme' of the Bio-based Industries Consortium (BIC). The objective of the programme is to identify opportunities for bio-based industrial activities in European countries where these activities are relatively under-exploited compared to their potential. Bio-based activities heavily depend on innovation, and hence are relatively low in 'moderate/emerging innovators'



countries. This may be the result of insufficient knowledge of the potential for the bio-based industry in these countries, by actors in bio-based activities in these countries as well as by BIC. Additionally, actors in these countries may not be fully aware of the opportunities offered by BIC and the Joint Undertaking it has with the European Commission.

This report does not pretend to be complete. Nor may it be based on the most recent statistical data. We've had significant assistance from contacts in industry, academia and government in collecting and reviewing data used in this report.

We would like to express our heartfelt gratitude to Professor Áron Török and his team at Corvinus University of Budapest for their exceptional professional support. We also extend our thanks to Barna Kovács, counsellor at the Permanent Representation of Hungary to the EU, and the Secretary General of the BIOEAST Initiative, for his valuable contributions.



2.

CURRENT BASIS OF THE HUNGARIAN BIOECONOMY

Hungary is a medium sized country in the EU according to land surface with 9.6 million inhabitants continuously decreasing over the years.

After a recession in 2023, the Hungarian economy is set to grow again. Following buoyant growth in 2022, real GDP decreased by 0.9% in 2023 (€197 billion, Eurostat 2023). It is projected to increase again by 2.4% in 2024 and by 3.5% in 2025, supported by falling energy prices, lower inflation and lower interest rates. Nonetheless the economic outlook remains sensitive to energy prices, potential supply disruptions and global investor sentiment.

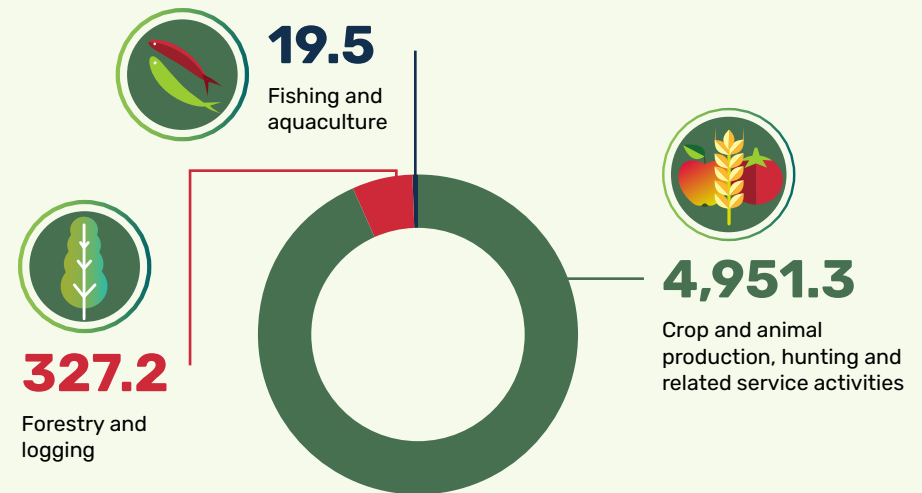
Employment held steady, and the employment rate remained above the EU average in 2023, which can support domestic demand in the future.¹

Beyond well-established industrial sectors (automotive, pharmaceuticals and electronics), the bioeconomy (encompassing primary production from agriculture, aquaculture and forest, food and feed industry as well as other bio-based products for different market) is more and more recognised as vital for the economic

growth of the nation. Slightly more than half of the total land area of Hungary is agricultural land and around a quarter of the total is forested.

The Hungarian agricultural sector is a significant exporter within the EU. Key crops include maize, wheat, sunflower, and

Figure 1. Gross Value Added of bio-based primary sector (current prices, M€, Eurostat, National accounts aggregates by industry, 2022)



¹ 2024 Country Report – Hungary (Brussels, 19.6.2024, SWD(2024) 617 final)



rapeseed. Livestock farming, particularly poultry and pork, are also relevant sectors despite facing recurring issues such as avian influenza and African swine fever. Moreover, the manufacturing of food and beverage is a considerable contributor to Hungarian economy with a fertile ecosystem of SMEs active in the field.

Forests account for the largest share of protected areas; while preserving biodiversity and protected areas, forest and logging bioeconomy is growing yearly, providing renewable resources for the wood products industry. Most of wood is used for bioenergy purposes with relatively small economic value; however, there is increasing growth in the wood processing industry producing bio-based construction and furniture materials.

Hungary is active in the production of biogas, biodiesel and bioethanol, which is seen as a strategic priority for reducing carbon emissions and enhancing energy security.

Hungary has a strong pharmaceutical sector with well-developed skills in biotechnologies. Beyond innovative companies active in the field of life sciences and pharma, agricultural biotechnology, food biotechnology, and environmental biotechnology are also growing and promising sectors, although not as large as the pharmaceutical and medical biotech industries.

Some biorefineries are present, mainly focusing on the production of biofuels. A few examples of new biorefineries focused on higher value bio-based products are present but the full potential is still untapped.

Figure 2. Gross Value Added of bio-based manufacturing sector (current prices, M€, Eurostat, National accounts aggregates by industry, 2022)

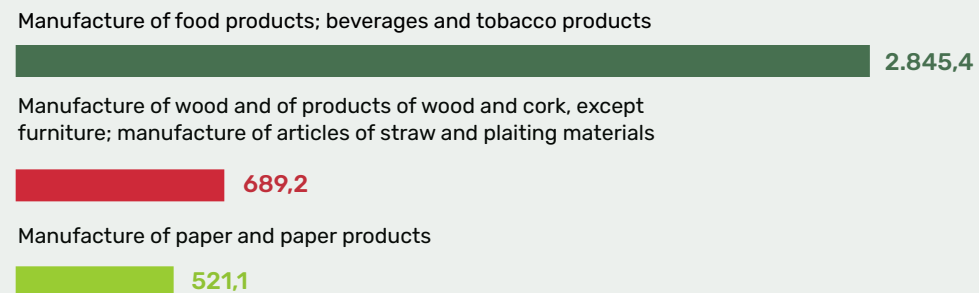


Figure 3. Gross Value Added of partially bio-based manufacturing sector (current prices, M€, Eurostat, National accounts aggregates by industry, 2022)





2.1. Agriculture

Of Hungary's total area of 93 030 km², more than 75% is rural, broken down to around 55% of utilised agricultural land and 23% forestland. The share of agriculture in the Hungarian economy of approximately 3.4% of GVA is well above the EU average which is around 1.5% (Eurostat, 2022)



3M

people live in rural areas in Hungary

Hungary has more than five million ha of utilised agricultural area. About three million people live in rural areas (30.5% of the country's total population).

Thanks to Hungary's unique natural characteristics, the conditions for agriculture are favourable in the country. Therefore, the sector is very diverse and plays an important role in the national economy. According to the Hungary CAP Strategic Plan, around 60% of Hungarian farms produce livestock - mainly poultry, pig, sheep and cattle - whereas crop production is focused not only on major field crops, but also on fruit and vegetables.

In recent years, both crop and livestock producers have faced unprecedented challenges. Crop farmers have been affected by rising energy costs, low market prices due to the cereal market crisis, and lost revenue as unsold cereals remained in storage. Additionally, severe droughts have worsened their situation. Livestock farmers, meanwhile, have been hit harder by recurring animal diseases and surging costs for feed and energy, making their situation more difficult than before.

The utilised agricultural area makes up 55% of the area of Hungary, a proportion notable among EU member states. No serious change occurred in the structure of

utilised agricultural area in the last years, so 82% of that continued to belong to the land use category of arable land (4.2 million hectares) and 16% to that of grassland (793 thousand hectares). The area of fruit plantations exceeded 83 thousand hectares in 2023, while that of vineyards remained somewhat below 60 thousand hectares.

A farming structure in transition - from small to medium size farms

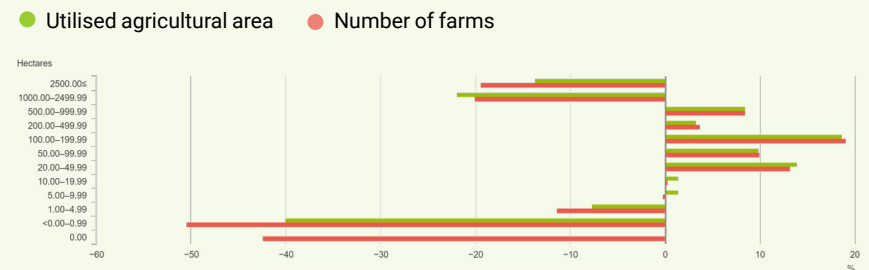
Between 2020 and 2023, the average sizes of farms were up to 14.7 hectares. Around 200,000 farms were operating in Hungary in 2023 (against more than 240,000 farms in 2020) with organisation in forms agriculture cooperatives still limited.



60%

of Hungarian farms produce livestock - mainly poultry, pig, sheep and cattle - whereas crop production is focused not only on major field crops, but also on fruit and vegetables.

Figure 4. % change between 2020 and 2030 in the number of farms and utilised agricultural area by size of farms (Hungarian Central Statistics Office data)





Farms with 1 to 5 hectares remained the most common, representing about one third of all farms, however accounting only for a 3.2% of the used agricultural area and with a decrease trend compared to previous years.

Although only 1.9% of farms operates on a medium scale of 200 to 500 hectares, they account for 20% of the total agricultural land. Over 2020-2023, there was growth in the number of farms and the land they utilised in the 10 to 1000-hectare range, with the most notable increase of 19% in farms sized 100 to 200 hectares. In contrast, the number of farms and land used by those cultivating over 1,000 hectares decreased by 20% in the period 2020-2023, still keeping more than 11% of used agricultural land.

Agriculture represents 4.8% of the country's employment. **There are 430,000 farmers in the country, 30% of them are over 64 years.** Upskilling of young farmers is essential for the future development and growth of agriculture in Hungary, promoting new jobs and retention of young people in rural areas.

Despite challenges posed by climate change, decrease in population, necessity of upskilling and a notable trend of rural-to-urban migration especially from young people, Hungary's agricultural sector holds several strengths and opportunities that can drive further growth:

- Hungary's strategic location in Central Europe offers advantageous logistics corridors, facilitating the movement of agricultural products to both Western European and Eastern European markets. The country is part of major transport networks, including the Trans-European Transport Network (TEN-T), which enhances export capabilities.
- The country is endowed with some of the most fertile soils in Europe, particularly in the Great Hungarian Plain. Hungary's chernozem soils,

known for their high organic matter content and excellent structure, make the land highly productive for cereal and sunflower cultivation, contributing significantly to the country's agricultural output.

- In the 2021-2027 period, Hungary is expected to receive approximately €7.2 billion in CAP funding, which will be directed toward modernisation, sustainability initiatives, and improving farmers' income stability (see chapter 3).
- Agriculture is a major contributor to Hungary's export economy. The country is a net exporter of cereals, particularly maize and wheat. In addition,

the livestock sector, particularly pork production, also plays a key role in exports.

As plant production is highly exposed to weather conditions, and increasingly to droughts, the Hungarian government is supporting investment in irrigation systems to mitigate yield fluctuation. The area suitable for irrigation has increased by more than 100,000 ha since 2020. In 2023, 5% percent of the country's agricultural area (258,000 ha) was irrigable, of which 153,000 ha was irrigated ([USDA data, 2023](#)).

2.1.1. Crop production

The impacts of the drought and the war in Ukraine on the crop production are visible in Table 1, especially in the harvested production of cereals.

While the cultivated/harvested/production area has remained practically constant throughout the period, the cereals production dropped significantly in 2022, before again reaching a high level in 2023.

Table 1. Harvested production in EU standard humidity (2018-2023, Eurostat, data extracted October 2024)

	2018	2019	2020	2021	2022	2023
Cereals for the production of grain (including seed)	14.890,26	15.643,37	15.561,08	13.969,54	9.055,71	15.082,14
Dry pulses and protein crops for the production of grain (including seed and mixtures of cereals and pulses)	34,34	41,64	27,25	31,94	25,15	29,29
Fresh vegetables (including melons)	1.520,02	1.492,81	1.424,16	1.398,19	1.232,32	1.428,20
Permanent crops for human consumption	1.452,09	1.184,79	1.004,38	1.130,50	970,37	1.079,23



Cereals

2022 was a difficult year for Hungarian cereals production; cold and dry conditions in March and April negatively affected winter crops; whereas persistent rain deficit combined with warm temperatures in the following months further diminished their yield potential.

However, Hungary was able to restart in a positive way in 2023, staying among the EU's top players in the production of grain maize and corn (accounting for 10% of total EU-27 production), barley and winter wheat.



Oilseeds

The land area for production of the main oil crops (sunflower and rapeseeds) was reported as 941,950 ha in 2023 with a total harvested production of 2,757.14 ktons (Eurostat, 2023). Sunflower seeds represents almost 70.9% of total harvested production and rapeseed 22.4%.



Hungarian sunflower seeds production in 2023 was around

20%

of the total EU-27 production for this crop.

Table 2. Production of cereals by area and tonnage (2023, Eurostat, data extracted October 2024)

	Area (cultivation/harvested/production) (thousand ha)	Harvested production in EU standard humidity (thousand tonnes)
Common winter wheat and spelt	1.012,73	5.726,61
Common spring wheat and spelt	3,32	11,87
Durum wheat	37,53	195,15
Rye and winter cereal mixtures	28,89	96,59
Winter barley	393,67	2.168,61
Spring barley	18,77	82,66
Oats and spring cereal mixtures (mixed grain other than maslin)	21,80	62,11
Grain maize and corn-cob-mix	767,85	6.272,52
Triticale	74,67	317,93
Sorghum	37,90	160,09
Other cereals n.e.c.* (buckwheat, millet, canary seed, etc.)	9,15	13,31
Rice	2,33	9,85

Table 3. Production of oilseeds by area and tonnage (2023, Eurostat, data extracted October 2024)

	Area (cultivation/harvested/production) (thousand ha)	Harvested production in EU standard humidity (thousand tonnes)
Rape and turnip rape seeds	188,94	618,52
Sunflower seeds	674,18	1.955,80
Soya	58,39	177,24
Linseed (oilflax)	2,31	2,89
Other oilseed crops (n.e.c)*	18,14	11,81

* not elsewhere classified



Permanent crops

Hungarian grapes cover around 57,000 hectares with a total harvested production of 412,520 tons, being the country renowned for its wine production, particularly in regions such as Tokaj, Eger, and Villány. Tokaji Aszú is a famous sweet wine made from grapes affected by noble rot. Tokaj, often referred to as the “wine of kings,” has a global reputation for its high-quality dessert wines. Wine exports significantly contribute to Hungarian agricultural economy.

Apple orchards are the most extensive, covering approximately 23,000 hectares. Hungary is one of the leading producers of apples in Central Europe, with around 50% for fresh consumption and 50% used for juice production.



Fresh vegetables

The main vegetable-producing regions include Central Hungary, Southern Great Plain and parts of Northern Hungary. The leading vegetables produced include tomatoes, sweet peppers, onions, carrots, cabbage, and cucumbers. Tomatoes and peppers are among the most significant crops, with greenhouse and outdoor production contributing equally.

According to [Eurostat interview](#), Hungary is among the 10 EU countries with the highest share of population above 15 years old to consume fruits at least once per day (the 1st in Eastern EU). However, obesity is a growing concern in Hungary, with nearly 60% of the adult population classified as overweight or obese.

Hungary is the

7th



most relevant EU-27 country for the production of the peppers (following Spain, Netherlands, Poland, Italy, Greece and Romania); particularly sweet paprika is iconic in the local cuisine and widely cultivated for both fresh consumption and processing into spices.

Table 4. Production of permanent crops by area and tonnage (2023, Eurostat, data extracted October 2024)

	Area (cultivation/harvested/production) (thousand ha)	Harvested production in EU standard humidity (thousand tonnes)
Fruits, berries and nuts (excluding citrus fruits, grapes and strawberries)	74,64	666,71
Grapes	56,74	412,52
Strawberries	0,88	5,33
Cultivated mushrooms	NA	51,05

Table 5. Production of fruits by area and tonnage (2023, Eurostat, data extracted October 2024)

	Area (cultivation/harvested/production) (thousand ha)	Harvested production in EU standard humidity (thousand tonnes)
Apples	22,79	484,46
Pears	2,41	15,39
Stone fruits	31,86	134,75
Peaches and nectarines	3,70	14,62
Apricots	5,55	14,03
Cherries	15,18	64,92
Plums	6,82	40,07
Other stone fruits n.e.c	0,61	1,11
Berries (excluding strawberries)	6,43	19,74
Nuts	10,43	8,98



Table 6. Production of fresh vegetables by area and tonnage (2023 estimation, Eurostat, data extracted October 2024)

	Area (cultivation/ harvested/ production) (thousand ha)	Harvested production in EU standard humidity (thousand tonnes)
Brassicas	2,08	58,28
Leafy and stalked vegetables (excluding brassicas)	2,12	34,93
Vegetables cultivated for fruit (including melons)	9,23	449,69
Root, tuber and bulb vegetables	7,78	226,70
Fresh pulses	20,12	107,99

Relevant players

- ✓ **Bonafarm** group is primarily known for livestock and food processing; however, they are also involved in large-scale crop production holding 34,000 ha of arable lands in Hungary producing each year 45,000 tons of winter wheat and 67,000 tons of maize. The product is cleaned and dried locally at plants in Ács, Mohács, Pálháza, Dalmand and Középhídvég. The company also owns livestock (including pig farming, cattle breeding and fish farming with a total production of 40,000 tons/y of meat products).

The company is well integrated downstream with final food/feed products manufacturers. 8,400 skilled and qualified employees are integrated across the value-chain within the different companies of the holding.

- ✓ **KITE Zrt.** is the largest agricultural integrator in Hungary, playing a central role in the nation's agricultural production and modernisation. In 2021, KITE Zrt. was awarded the Agricultural Innovation Award by the Hungarian Innovation Association for the development of the PGR - Precision Agriculture System.

The company offers arable farming, horticulture, logistics and animal husbandry and distribution of agricultural machinery and supplies. This includes maize, sugar beet, and oilseeds, among other crops.

The Serbian subsidiary of KITE Zrt. opened a new logistics centre in Cenej in Serbia benefitting of the support of the Hungarian government granted state aid as part of the investment programme of the Hungarian Export Development Agency HEPA.

- ✓ Hungary is among top producers of oil crops in Europe. The sector is dominated by foreign players Cargill, Bunge, ADM. Viterra is a Hungarian company active in the production of oilseeds and vegetable oils.

- ✓ Association of Hungarian farmers' circles and farmers' cooperatives (**MAGOSZ**) is among the main interest protection organisation of Hungarian farmers. Its rural base consists of hundreds of local farmers' circles and 19 county farmers' associations, and it also has a National Section of Young Farmers and a National Section of Women Farmers. **MOSZ** is a broad association of farmers and cooperatives in Hungary part of EU COPA-COGECA association and with a strong role in advocating farmers interests at national and EU level.

- ✓ More than 50% of fruits and vegetables are produced by small farms. Relevant associations represent this sector among which **FruitVeb** is particularly active.

- ✓ **Biokontroll Hungária Kft** is the Hungarian umbrella organisation representing organic farming, also providing certification and advisory services for farmers who produce organic crops and livestock.



2.1.2. Livestock

As of June 1, 2023, Hungary's cattle population decreased to 876,000, continuing a decline since 2020, with fewer farms keeping livestock. The pig population remained stable at under 2.6 million, though smaller farms continued to close. Chicken numbers saw a notable rise to 34.5 million.



Hungary ranks among the top poultry producers in the EU

Despite fewer livestock keepers, average farm sizes for both cattle and pigs grew, with pig farms averaging 104 heads per farm.

The Russia-Ukraine war exacerbated grain price volatility, and consecutive droughts have made feed production more expensive, reducing profitability for many farmers.

This, coupled with increased energy prices, has strained operations, particularly for smaller farms that struggle to maintain competitiveness.

Moreover, African Swine Fever (ASF) has negatively affected pig populations, further limiting the industry's capacity for growth.

Table 7. Livestock thousands heads June 2020–June 2023 (2023 estimation, Hungarian Central Statistic Office)

Livestock	1 June 2020	1 Dec 2020	1 June 2021	1 Dec 2021	1 June 2022	1 Dec 2022	1 June 2023
Cattle	933.3	932.9	931.6	902.1	902.7	885.3	876.0
Pigs	2,919.9	2,850.2	2,886.3	2,725.9	2,714.8	2,558.1	2,560.0
Sheep	993.6	943.8	958.3	887.0	928.5	871.7	922.2
Chickens	31,097.4	28,887.9	33,446.5	32,114.4	29,868.0	29,124.0	34,543.7
Geese	1,824.3	798.0	2,190.6	951.9	1,693.2	613.6	2,147.6
Ducks	1,925.4	2,969.8	3,908.0	4,241.0	1,497.5	2,727.3	2,725.6
Turkeys	3,325.3	2,741.6	3,136.1	2,636.3	2,536.5	2,518.5	2,511.6



2.2. Forest

Forestry plays an important role in Hungary's bioeconomy, both in terms of environmental sustainability and economic output. Some 23% of Hungary's territory (more than 2 million ha) is covered by forests with around 19,000 employees in forests and logging (Eurostat, 2023). Forests account for the largest share of protected areas (according to Hungarian Forest Research Institute, 62% of the forest land is under some kind of nature conservation, either under national protection or under Natura 2000).



23%

of Hungary's territory is covered by forest

€327.1Mt

Gross added value of the forest sector (2022)

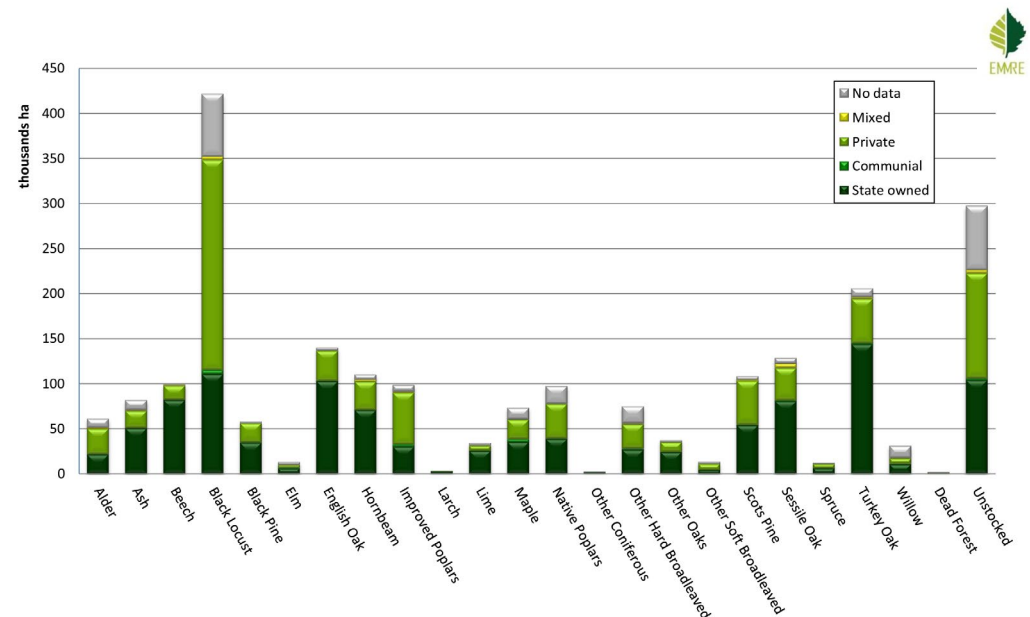
↑ 37%

compared to 2020

Data from Eurostat 2022 reveals that forest and logging economy is growing across years; the gross added value of the sector has moved from €238.5 million in 2020 to €327.1 million in 2022 (+37%). Forests in Hungary provide significant resources for the wood products industry, including bioenergy, timber, paper, and wood-based panels, which contribute to exports and rural employment.

Most of the forest area (89%) is occupied by deciduous species, with black locust and oaks accounting for the largest share. 63% of the forests are indigenous, and 37% are non-native species or breeds. Due to the afforestation, the forest area of Hungary has increased further in the last 10 years. More than half of forest lands are owned by the State.

Figure 5. Forest area according to tree species group and ownership category (Hungarian national forestry inventory)



Source: NLC Forestry Department, NFI 2015-2019



The species composition of Hungarian forests is uniquely diverse. Native hardwoods like oak, turkey-oak, beech and hornbeam comprise 63% of the forest. The remaining 37% is covered with introduced wood species such as black locust, red-oak, as well as some spruce and pine species.



In Hungary the share of state-owned forests is 56% and that of community-owned is 1% and 43% of forests are private. A long-term purpose, primarily based on afforestation, is the large-scale increase of private and community owned areas.²

Around 7.3 million m³ of roundwood removals over bark are harvested from the Hungarian forest. The majority (53.6%) is used for fuelwood while 18.2% for sawlogs and veneer logs and 16.8% for pulpwood.

Table 8. Roundwood removals over bark by type of wood and assortment (thousand m³, Eurostat 2023, data extracted October 2024)

	Coniferous	Non - coniferous	Total - all species
Fuelwood (including wood for charcoal)	239,38	3.664,86	3.904,24
Sawlogs and veneer logs	169,72	1.156,75	1.326,84
Pulpwood, round and split	633,18	589,16	1.222,34
Other industrial roundwood	105,63	726,18	831,8

Relevant players

-  The proprietary rights of state-owned areas by the assignment of the Minister of Finances are practiced by **MNV Zrt.**, the **Hungarian National Asset Management Company**. The Hungarian National Asset Management Company, as proprietor, assigns state-owned forest land areas into the custody of the 100% state-owned, mostly forestry corporations.
-  **MEGOSZ** is the national Association of Private Forest Owners in Hungary representing approximately 1,000 individuals, local and regional organisations of private forest owners, forest co-operatives and forest management enterprises.

² Deliverable 2.1 "Country Report Hungary"- Celebio project. This project has received funding from the BBI JU (Bio-based Industries Joint Undertaking) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 838087.



2.3. Food and beverages

The manufacturing of food and beverage is a considerable contributor to Hungarian economy, accounting together for a net turnover of more than €18 billion, employing more than 110,000 people and with approximately 7,120 companies of different sizes (Eurostat, 2022).

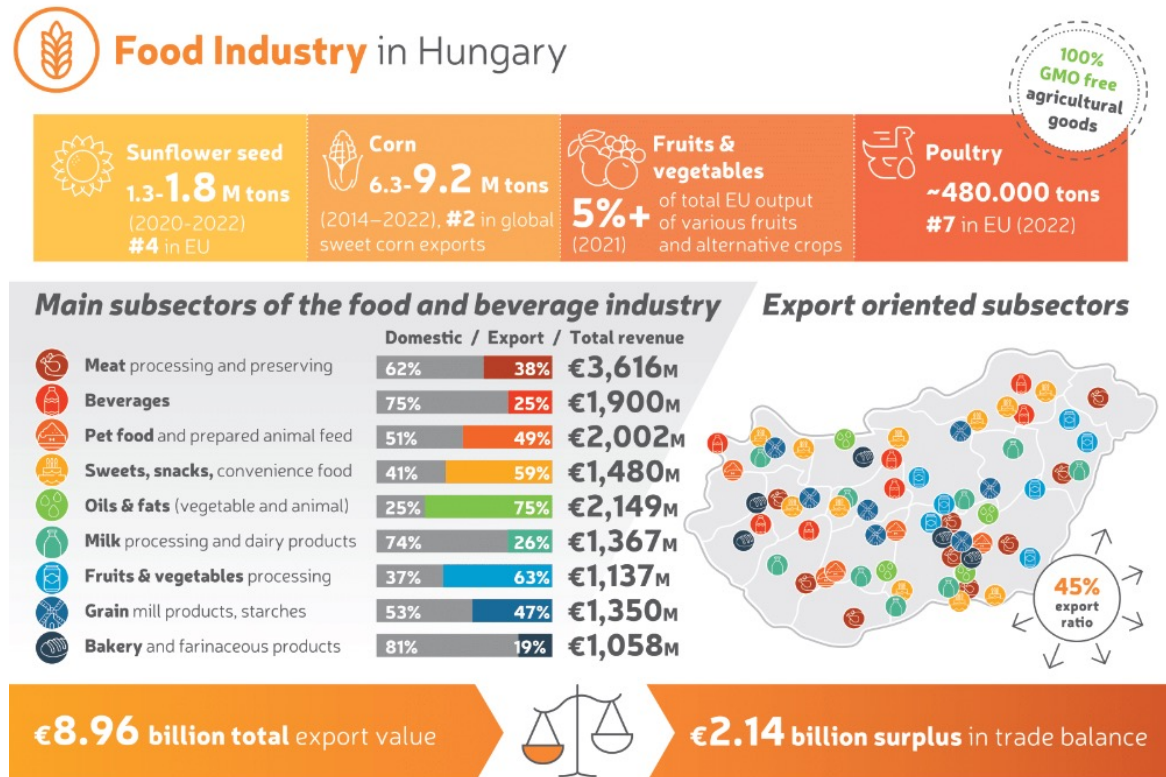
The distribution of number of companies and net turnover per size of companies (micro, small and large) reveals that 58 large players are present in the market with growing penetration from SMEs contributing to approximately 50% of the net turnover.

Revenues per main sub-sectors of the food and beverage industries have been reported by HIPA (Hungarian Investment Promotion Agency) combining data from Eurostat and Hungarian Central Statistical Office. Hungary is the 4th EU country for the production of sunflower seed and is the 7th EU country in the production of poultry (0.48 million tons in 2022).

Table 9. Number of enterprises and net turnover in food and beverage manufacturing industry per size of company (2022 Eurostat, data extracted October 2024)

	No of enterprises	Net turnover (M€)
Micro (from 0 to 9 persons employed)	5.688	655,07
Small-Medium (from 10 to 249 persons employed)	1.374	8.542,77
Large (more than 250 persons employed)	58	9.634,12

Figure 6. Revenues per main sub-sectors of the food and beverage industries (Hungarian Investment Promotion Agency)





Within the food sector, meat processing and preserving the highest by turnover (€3.6 billion) followed by oils and fats, pet food and beverage. Within the meat industries, the poultry meat processing and preserving industry has become the most relevant one.

Beverage is also a relevant sector. Production of soft drinks leads, with around half of the total sold production value of €872.6 million (**Eurostat 2023**) is followed by beers and wine.

Milk and derived products are also relevant for Hungary domestic consumption.

Table 10. Milk and dairy products (data Eurostat 2023 data extracted October 2024)

Product class	Quantity (thousand tones)
Drinking milk	520,57
Cream for direct consumption	12,27
Acidified milk (yoghurts and other)	107,95
Butter	5,29
Cheese	85,19

Relevant players

- ✓ **National Association of Food Processors (ÉFOSZ)** is the national organisation representing the economic and professional interest of Hungarian food companies.
- ✓ Multinational food (including PET food) and beverage companies active in Hungary: Coca-Cola, Nestlè, Bonafarm Group, Cargill, Evonik, Bunge, ADM, Mars Inc., Dreher, Heineken and others.
- ✓ Among Hungarian meat processing industry (including SMEs): Bonafarm Group (Pick Szeged Zrt., Hungerit Zrt.), Master Good Ltd, Hajdúhús 2000 ltd., MCS Vágóhíd Zrt., KOMETA 99 Zrt., Gallicoop Pulykafeldolgozó Zrt., Pápai Hús Zrt., Zimbo Perbál Kft. (Part of Bell Food Group), Gyulahús Kft.



2.4. Wood-based industrial sector



Wood industry sector accounts for more than €2.3 billion of production value with more than 2,000 companies active in the sector and 26,500 employees (Eurostat, 2020). This includes the manufacturing of wood products as well as paper and paper products.

The sector which is growing more is the manufacturing of veneer sheets and wood panels, for which the production value doubled from 2011 to 2020.

Hungary had a great tradition of wood-based panel manufacturing, but through the privatisation of state-owned enterprises, several smaller plants emerged, while the larger facilities were soon acquired by foreign companies.

Relevant players

✓ Derula Manufacturing and Trade Co. in Szolnok, in Central Hungary, OWI Zala Bt., Fibreboard Manufacturing Co. of Mohacs (MOFA) and KRONOSPAN Holding Limited formed KRONOSPAN-MOFA Hungary Fibreboard Manufacturing kft.

Moreover, FALCO Zrt. joined KRONOSPAN Holding in 2007. Since then, it has turned out to be the largest furniture and structural panel manufacturer in Central-East Europe.

Table 11. Number of enterprises and production value in wood-based industries (Eurostat, data referred to 2020)

	No of enterprises	Production value (M€)
Sawmilling and planing of wood	584	180,0
Manufacture of veneer sheets and wood-based panels	43	289,2
Manufacture of wooden containers	301	137,1
Manufacture of other wood products; manufacture of articles of cork, straw and plaiting materials	664	39,6
Manufacture of paper and paper products	491	1.708,6
Total	2.083	2.355

✓ Emerging innovation trends in the field of wood industry are testified by the case of MOFA-Hungary LLC which received financial support to switch from using the wet process to a more environmentally friendly dry fibreboard manufacturing technology. This increased production capacity and by-product utilisation.

✓ Companies active in pulp and paper and paper products manufacturing include Hamburger Hungaria Ltd., Dunapack packaging, Mondi Group, Vajda-Papír kft, Dunafin Zrt.

A **national association** grouping pulp and paper industries (including printed paper) is active.



2.5. Chemical and pharmaceutical industry



The chemical industry sector accounts for more than €5.8 billion of production value (corresponding to a gross value added of €4.6 billion) more than with 1,834 companies active in the sector and more than 55,300 employees ([Eurostat, 2020](#)).

This includes the manufacturing of basic chemicals, fertilisers, plastics and synthetic rubber materials and final products, paints, varnishes, coatings, soaps, detergents and pharmaceuticals.

The manufacture of basic chemicals, fertilisers and plastics, together with the manufacture of pharmaceutical products and preparation, accounts for the largest share of the total production value with equal distribution among the chemical and pharma sector.

Table 12. Number of enterprises, production value and number of employees in chemical and pharmaceutical industry ([Eurostat](#), data referred to 2020)

	No of enterprises	Production value (M€)	No of employees
Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms	155	3.031,0	8.209
Manufacture of paints, varnishes and similar coatings, printing ink and mastics	52	229,3	1.607
Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	317	389,3	3.241
Manufacture of other chemical products	109	288,1	1.142
Manufacture of basic pharmaceutical products and pharmaceutical preparations	79	3.228,1	19.170
Manufacture of rubber and plastic products	1.834	5.738,8	55.321



Relevant players in chemical and pharma sectors

- ✓ Gedeon Richter Plc. is a European multinational pharmaceutical and biotechnology company headquartered in Budapest. It is the largest pharmaceutical company in Central and Eastern Europe, with an expanding direct presence in Western Europe, China, Northern America and Latin America. Richter has the largest R&D unit in Central and Eastern Europe and operations in over 100 countries.
- ✓ EGIS Pharmaceuticals is also a leading Hungarian player in pharmaceutical industry with three production sites in Hungary.
- ✓ MOL Group is the main oil and gas company in Hungary, and it integrates also the production of chemicals (monomers, polymers, polyols and base chemicals).
- ✓ BorsodChem, and Nitrogénművek are large Hungarian players in the chemical industry.



Focus on emerging biotech applications beyond pharma

Hungary's biotech industry is a growing sector playing a key role in the country's economy, supported by a strong tradition in pharmaceutical research and manufacturing.

BioTalentum is a Hungarian leading provider of stem cell models and transgenic cellular and animal models. The company's human cellular systems and animal models support biomedical research and drug testing, providing a useful tool for research teams and the pharmaceutical industry. The company has a strong focus on R&I as testified by its wide participation to Horizon programme with more than 30 funded projects (coordinator of iNanoBIT project- Integration of Nano- and Biotechnology for beta-cell and islet Transplantation).

Solvo Biotechnology is a prominent Hungarian company that specialises in the field of transporter protein research and drug-drug interaction studies. Founded in 1999, Solvo has established itself as a global leader in the field of membrane transporter assays. Their primary focus is on providing cutting-edge solutions and technologies for pharmaceutical and biotechnology companies to help them understand how drugs are transported in and out of cells, which is crucial for drug safety and efficacy.

X-Chem is a biotechnology company based in Hungary that specialises in drug discovery using DNA-encoded library (DEL) technology.

The company has a strong reputation for its innovative approach to small molecule drug discovery, helping pharmaceutical and biotech companies accelerate the identification of novel drug candidate.

Beyond innovative companies active in the field of life science, agricultural biotechnology, food biotechnology, and environmental biotechnology are also growing promising sectors although not as large as the pharmaceutical and medical biotech industries.

For example, Marton Genetics is a relevant player working on non-GMO hybrid seeds, especially for maize, sunflower, wheat, and barley. The company focuses on developing drought-resistant and high-yield varieties that are adapted to Hungary's climate and agricultural needs. Phylazonit has been pioneering soil-centred thinking and bacterial formulations (microbial agricultural products).

Moreover, biotechnologies are deploying some innovations and new business opportunities in Hungarian economy beyond pharma including the production of biofuels and biochemicals (see the section below dedicated on biorefineries).

The main biotech industries are grouped within the **Hungarian Biotechnology Association**.



2.6. Existing industrial biorefineries



Being an agriculturally rich country and with growing afforestation, Hungary can leverage its resources in biorefinery processes. Some examples of first generation biorefineries, where biomass is converted mainly into bioenergy and biofuels with recovery of value-added bio-based products, are present in Hungary.

Some relevant companies are also active in the production of sugars from agricultural crops used in fermentation processes. Only a few examples are focused on the production of bio-based chemicals and materials beyond the production of biofuels.

Some relevant demonstration projects showcase also the potential for full industrial scale-up of some innovative technologies. For example, Terra Humana Ltd has developed (also thanks to national and EU funding) a demo plant for the production of Bio-phosphate via pyrolysis technology of waste from animal bones by-products. The 3R pyrolysis demonstration equipment with a 2,000 t/year throughput capacity is currently in operation in Polgardi. The main bio-based product is branded as 'ABC' Animal Bone biochar", an innovative and recovered phosphorus fertiliser produced from by products in line with the EU bio nutrient circular phosphorus economy model.

In 2016 Terra Humana Ltd. Edward Someus has been selected as a Member of the EU DG Grow-JRC STRUBIAS (struvite-biochar-ash) Expert Group, a sub-class of the Commission Working Group on fertilisers.

Table 13. Existing biorefineries in Hungary - data from [Celebio BBI-JU project](#) integrated with additional desk research

Company	Type of feedstock	Products
Hungrana Starch and Isoglucose Manufacturing and Distributing Ltd	Corn	Sugars, starch + 450 m3 of bioethanol/day including valorisation of by-products to produce animal feed. Biogenic CO2 from bioethanol plant captured (agreement with AirLiquid).
Pannonia Bio Zrt	Feed corn	The biorefinery annually processes over 1.1 million tons of feed corn to produce 325,000 tons of protein-rich animal feed, 500 million litres of bioethanol and 12,000 tons of corn oil. The biorefinery supports over 3,000 jobs, mostly in rural communities.
Kall Ingredients Kfr	Maize	Sugars and starch products, high-quality alcohol (ethanol at different quality grades both for food and industrial use) through fermentation and feed ingredients.
Agrár-Béta Mezőgazdasági Kft.	Maize including damaged maize	6 million litres of bioethanol annually produced. The alcohol is also used captively for the production of alcohol based products (including detergents).
Rossi Biofuels	Fresh vegetable oils (mainly rapeseed oil) + waste cooking oils	3 production lines, total capacity of 150,000 tonnes/year of biodiesel production. During the process, bio-based glycerol is also recovered.
Meshlin composites ZRT	Natural fibres (flax)	Bio-based composites production for different application sectors (mainly furniture and transport).
Arany Kapu Borászati Melléktermék Feldolgozó Zrt.	By-products from wine value chain (grape marc and wine lees)	Alcohol, denatured alcohol, tartaric acid, calcium tartrate and grape seed for oil extraction.
Kometa 99 Zrt	By-products from pork processing	Production of protein flour for PET food production and industrial fats and oils for further use in the production of biochemicals/biofuels.



3.

NATIONAL STRATEGIES SUPPORTING BIOECONOMY GROWTH

While a dedicated national bioeconomy strategy is being developed different existing strategies and action plans are relevant to the bioeconomy sector providing evidence on the contribution that the whole bioeconomy sector can provide to the achievement of the specific targets in terms of decarbonisation/defossilisation, increased competitiveness and socio-economic growth, strategic autonomy and resilience.

Towards a national circular economy strategy for Hungary - OECD report in collaboration with the Prime Minister Office of Hungary

Hungary has committed to developing a National Circular Economy Strategy and Action Plan to harness its resource efficiency potential by 2040.

To achieve the 2040 goals, Hungary aims to double its resource productivity and increase its circular material use rate to 15%. Hungary also seeks to increase circular economy jobs by 30%, reaching 2.5% of total employment, primarily in industry, agriculture, and services. Key sectors to be addressed are food, construction and plastics.

In 2020, Hungary produced 749,000 tons of food waste, of which only half was recovered. Hungary's transition strategy proposes new regulations to encourage quality compost use in agriculture, separate bio-waste collection, and redefine bioenergy policies.

In construction, circular practices are essential, as over half of Hungary's raw materials are used in the built environment. The sector also accounts for around one-third of waste generation. The strategy recommends developing standards for secondary construction materials, extending renovation support systems, and mandating selective demolition.

Plastics play a crucial role in Hungary's economy, especially in packaging, construction, and transport. However, only about one-third of plastic waste is recycled. The strategy suggests promoting designs that facilitate recycling, introducing economic incentives like extended producer responsibility fees, and increasing taxes on landfilling to encourage recycling.





Hungarian Common Agricultural Policy (CAP) strategic plan (2023-2027)

Hungary also applies strengthened good agricultural and environmental conditions, requiring farmers to carry out practices that are beneficial for the environment, such as crop rotation and diversification, maintenance of landscape features or ensuring soil cover during sensitive periods.

Furthermore, through the development and maintenance of grasslands, non-productive areas, wetlands, habitats and conservation of trees, farmers will also contribute to the improvement of the carbon sequestration capacity of soils and ecosystems. In financial terms, Hungary allocates 38% of the rural development budget to agri-environmental interventions, 8% to the further development of organic farming and about 3% to the protection of Natura 2000 agricultural sites.

These schemes added together will contribute to sustainable nutrient management and the reduction of fertiliser application and ammonia emissions. In addition, Hungary's ambition is to double the area under organic farming by 2027.

Moreover, the Plan also introduced eco-schemes, under which farmers are paid for practices that go beyond the minimum legal requirements in terms of climate and the environment. The Plan expects that these practices will be implemented on 2.5 million hectares. Farmers can receive a lump sum corresponding to €80/hectare annually for carrying out voluntary practices,

with focus on soil and water biodiversity protection and climate change mitigation. The Plan also promotes the afforestation of 16,174 hectares of land and sustainable forest management on an additional 127,000 hectares.

The Plan supports the generational renewal of the agricultural sector by facilitating the setting-up of 6,800 young farmers. Moreover, specific actions are foreseen for increasing knowledge exchange and the dissemination of information.



At a glance:

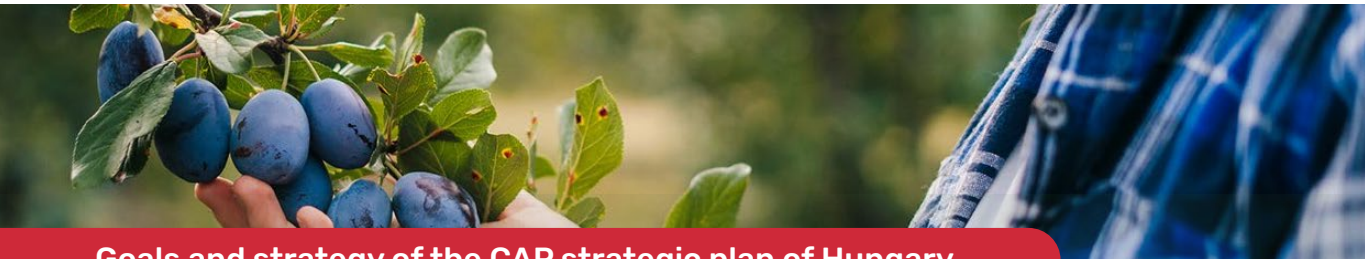
HUNGARY'S CAP STRATEGIC PLAN

Agriculture and Rural Development

Table 14. Financial overview



	EU budget (€)	National funding (€)	Total (€)
Direct payments	6.632,794,974	NA	6.632,794,974
Sectoral support	186,997,866	20,666,935	207,664,801
Rural development	1.635,146,596	1.599,162,785	3.234,309,380
Total	8.454,939,435	1.619,829,720	10.072,769,155



Goals and strategy of the CAP strategic plan of Hungary

- To recognise the difficulties and disadvantages faced by small and medium-sized farms, farmers get an additional €80/hectare for their first 10 hectares of land and €40/hectare for areas between 10 and 150 hectares.
- Farmers in 13 sectors (such as fruit and vegetables, ewes, suckler and dairy cows, fattening bulls, protein crops, sugar beet, rice, and oil plants) would operate at a loss in Hungary. In order to address their specific difficulties, they receive coupled income support, ranging from €28/female sheep to €728/hectare for rice production.
- Hungary supports the improvement of the water balance on 1,005,794.60 hectares of agricultural land.
- Participants in the voluntary agro-environmental payments undertake to carry out additional farming activities on one million hectares, in order to protect permanent grasslands, wetlands, cultivated parcels with steep slopes, wild bird habitats and lands subject to drought or excess water.
- Around 30% of the rural population benefit from improved rural services and at least 7,000 new jobs are created by projects supported by the Plan.
- 50% of livestock units are covered by measures to improve animal welfare.
- Hungary aims to support 1,565 rural infrastructure projects such as local markets, road developments, community centres, small-scale residential wastewater treatment units and local Wi-Fi.
- 736,210 people benefit from advice, training, and knowledge exchange supported by the CAP, related to environmental or climate-related performance.
- 1,550 farms get support for the digital transition.

National Clean Development Strategy 2020-2050

The National Clean Development Strategy outlines the pathways toward climate neutrality and confirms that the Hungarian government is taking concrete actions to combat climate change.

With this background, Hungary is clearly choosing a clean future that follows the path of climate protection, energy sovereignty, and green economic development.

- Significant investments will be needed to electrify the economy, especially in the transport, residential, and commercial sectors.
- Further investment will be needed in the development of CCUS technology, increasing the utilisation of renewable energy and energy storage systems. Given carbon phase-out efforts, new investment in fossil fuel-based technologies and industries runs the risk of rapidly depreciating assets (i.e. stranded assets).
- Besides more efficient industrial processes and product use (IPPU), CCUS technologies and alternatives to replace fossil energy sources (as raw material) are needed in the future. These alternatives can be carbon-free or low-carbon hydrogen and its derivatives as well as alternative biological raw materials. Furthermore, raising public awareness to shape consumption patterns and promoting the transition to a circular economy will have a significant positive impact on industrial emissions.



- Besides the electrification of the transport sector, expanding the application of second generation (or advanced) biofuels and hydrogen, as well as the more efficient usage of fuels and the gradual decrease in using liquefied petroleum gas (LPG) on the market, will contribute to decarbonizing and modernising the sector.
- In agriculture, a reduction in fertiliser use; a more efficient use of organic fertilisers; and a wider application of precision farming, automatisisation, and digitalisation will be needed. Moreover, investments targeting feeding, irrigation, and energy efficiency are key. The LULUCF sector will require significant investments to enhance net CO₂ capture (sink capacities) after 2030. This will be especially needed for measures that improve forest adaptation, reduce logging in the medium term, and increase afforestation efforts in the long term. For sustainable forestry, the maintenance of stocks with the most optimal CO₂ equilibrium and business model (regarding area and age structure) needs to be emphasised. Furthermore, interventions should support maintaining and developing forests while protecting their natural levels despite climate change impacts.
- The waste sector will require significant investments to drastically reduce landfilling. Reducing landfills, diverging waste flows, and improving waste treatment methods account for around 90% of the emission reductions of the sector. Further investments will be needed to reduce the amount of industrial waste, to improve municipal waste treatment, and to prevent waste in the first place.

Updated national biogas and biomethane action plan

The updated national biogas and biomethane action plan from the Hungarian Ministry of Energy identifies key facts and figures of the current biogas/biomethane production and future targets by 2030.

There are currently 80 enterprises operating at 104 biogas production sites across Hungary.

Most of these plants (85 out of 104) produce both electricity and heat, while 19 facilities focus solely on heat production.

In 2022, the total biogas production was 203 million cubic meters (Mm³), generating 4,053 TJ of energy, with 35 Mm³ used for heating the biogas reactors themselves.

The Kaposvári Cukorgyár is the only plant currently injecting biomethane into the natural gas grid (since 2016). In 2023, PannoniaBio also started biomethane production, and two more plants (ALTEO and Bakonykarszt) are expected to join the market by 2024.

Sectoral Breakdown:

- Agriculture: In 2022, 16 agricultural businesses operated 18 biogas plants, producing about 1 Mm³/year each, mainly from cattle manure.
- Industry: Two large chemical plants, including

PannoniaBio, produced a significant share of biogas (averaging 10 Mm³/year).

- Water utilities and waste: 32 water utilities and 26 waste management companies produced biogas, often using sewage sludge and landfill gases.

The total installed capacity for biogas-based electricity generation is 83.27 MWe.

The target is to triple biogas production by 2030, aiming for 600 million cubic meters (m³) annually. This would result in approximately 184 million m³ of biomethane, requiring the establishment of 25 new plants with an average capacity of 1,000 m³/hour. The plan focuses on ensuring that biogas production does not negatively impact soil quality and on promoting the use of alternative sources like wastewater, organic waste, and food industry by-products.

It is also emphasised that digestate from biogas production could play a crucial role in replacing chemical fertilisers, which are largely produced using imported natural gas, thereby improving soil health and reducing Hungary's fertiliser imports.



BIOEAST Bioeconomy Concept Paper

Important contributions to define the upcoming national bioeconomy strategy are being provided by BIOEAST initiative (see par6.4). Specifically, BIOEAST has contributed to define some directions to spur Hungarian bioeconomy growth.

According to the document, key strengths in Hungary's bioeconomy include biomass potential in agriculture and forest areas, untapped potential in bio-waste and freshwater resources (blue bioeconomy), and strong engineering skills that could strengthen biorefinery potential. There is also a sense of responsibility and commitment towards sustainability among younger generations.

The main actions/directions proposed by BIOEAST for the national bioeconomy growth include

➔ Support small-scale, new generations of biorefineries through the creation of an action plan that involves relevant stakeholders. This plan should use a fact-based approach to map and monitor sustainable biomass availability, optimise biomass production and use, create value-added products, support local markets, and preserve biodiversity and the environment, while also determining biomass's role in the energy mix.



Mission

The concept paper has a triple goal. To bring current challenges on natural resources and primary production sectors (agriculture, forestry and aquaculture) into public consciousness. It also aims at creating a platform for long-term, cross-sectoral dialogue among stakeholders on the future of biomass related sectors, and on the necessity of paradigm shift in economic thinking in order to cope with climate change. Finally to set the framework for a national bioeconomy strategy and action plan development.

- ➔ Build a safe food system and promoting a healthy diet by raising awareness of a healthy lifestyle. Support for new business models and innovative start-ups aims to derive added value from biological waste. Additionally, biodiversity support, crop diversification, drought mitigation, and prevention programmes should be considered, with digitalisation playing a role in improving efficiency in the food industry.
- ➔ Adding value to forests bioeconomy, creating and updating research infrastructure, and increasing human resources in the number of researchers and skilled workers. Public support for wood as a durable building material could help replace more energy-intensive materials.
- ➔ Increasing the amount of organic matter returned to soils by at least 30% from 2021 to 2030, alongside developing and maintaining large-scale experimental research infrastructure and raising awareness of soil health.
- ➔ Initiating discussions on carbon capture utilisation and storage technologies with relevant stakeholders.
- ➔ Develop a national R&I programme focused on bioeconomy, including a national strategic research and innovation agenda with annual call for proposals on different topics.



4.

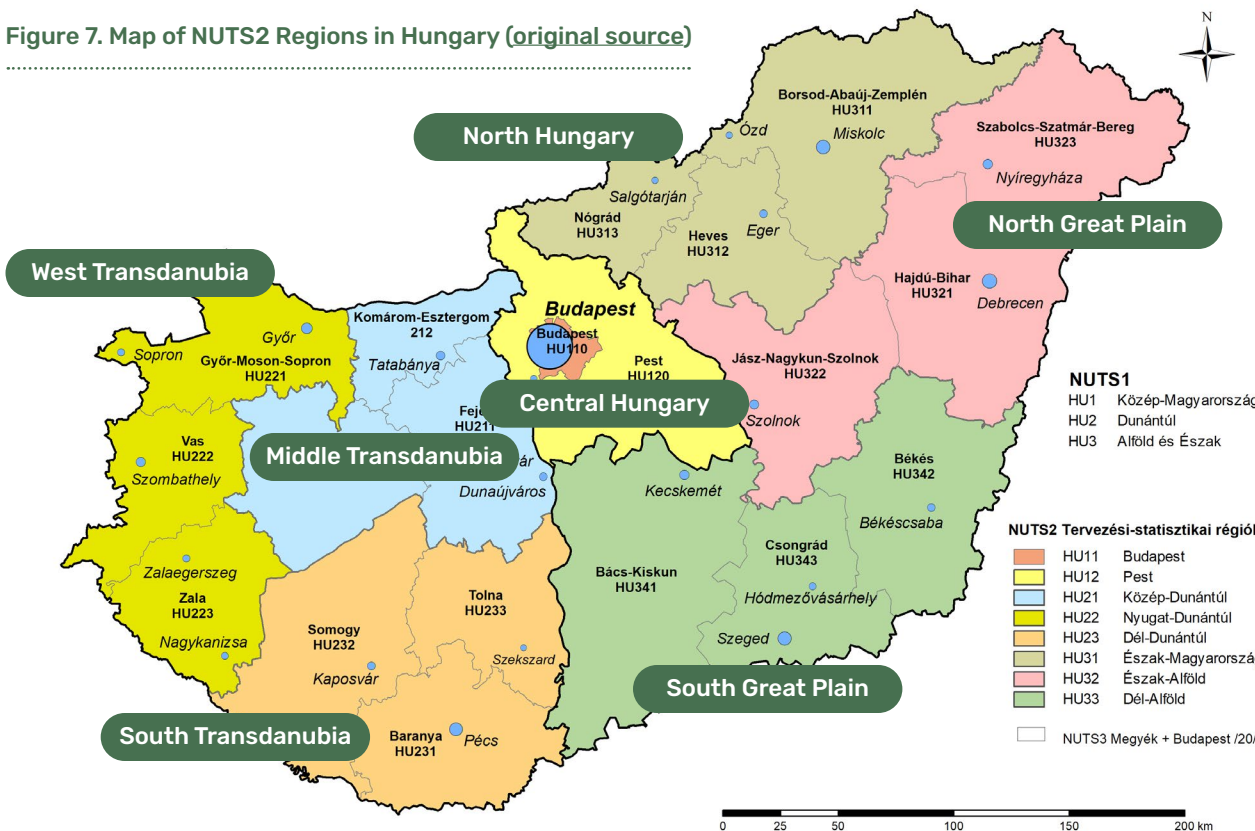
THE REGIONAL DIMENSION OF HUNGARIAN BIOECONOMY

4.1. Regional features

The Hungarian territory is divided according to NUTS-2 classification into 8 regional areas:

- H11- Budapest- dominated by the capital, Budapest, this region is the country's political, economic, and cultural centre. It has the highest population density.
- H12- Pest- it surrounds Budapest in Central Hungary and serves as a suburban and economic hub. It features a mix of urban, rural, and natural landscapes, with many residents commuting to the capital. Key industries include manufacturing, logistics, and agriculture. The region benefits from strong transportation links but faces challenges with urbanisation and infrastructure demands due to its rapid suburban growth.
- H21- Central Transdanubia-industrial and historical region, with a strong automotive industry presence. The area also includes Lake Balaton's northern shore.
- H22- West Transdanubia- thanks to well-developed infrastructure and proximity to Austria and Slovakia, this region benefits from cross-border trade and investment.
- H23- South Transdanubia- A less industrialised region, it is known for its agriculture, cultural heritage, and wine production, especially in Villány and Szekszárd.
- H31- North Hungary- mountainous and rural, with some industrial areas. It is one of Hungary's less developed regions, but rich in natural resources like thermal waters and caves. It was historically focused on mining and heavy industry.

Figure 7. Map of NUTS2 Regions in Hungary (original source)





- H32- North Great Plain- dominated by agriculture due to its flat plains, this region is a major agricultural hub. It is also home to important universities and health spas.
- H33- South Great Plain- A vast, flat agricultural region known for its food production, especially paprika and fruits. It also has cultural significance with Szeged as a key centre.

As reported in the S3 Smart Specialization Strategy, the counties of Hungary are classified into the following types of regions:

- Knowledge regions (Budapest capital, and Csongrád-Csanád, Győr-Moson-Sopron, Hajdú-Bihar, Pest, Veszprém, Baranya, Borsod-Abaúj-Zemplén counties),
- Industrial production zones (Fejér, Heves, Komárom-Esztergom, Vas, Zala, Bács-Kiskun counties),
- Moderate knowledge and technology intensive areas (Békés, Jász-Nagykun-Szolnok, Nógrád, Somogy, Szabolcs-Szatmár-Bereg, Tolna counties).

4.2. Regional contribution to bioeconomy

As it can be outlined from the regional dataset:

- Regions mostly contributing to agriculture are Southern Great Plain, North Great Plain and South Transdanubia
- South Transdanubia is leading in forest
- All regions have a well-developed industrial ecosystem in food and beverage with Southern Great Plain, North Great Plain South Transdanubia and Pest having the largest share in terms of added value
- West Transdanubia is strongly contributing to wood products and furniture manufacturing
- Paper production is mainly concentrated in Pest and Central Transdanubia

Figure 8. Value added share in the bioeconomy in Hungary NUTS2 Regions- green refers to agriculture and yellow to manufacturing (data from BioRegEU dashboard)

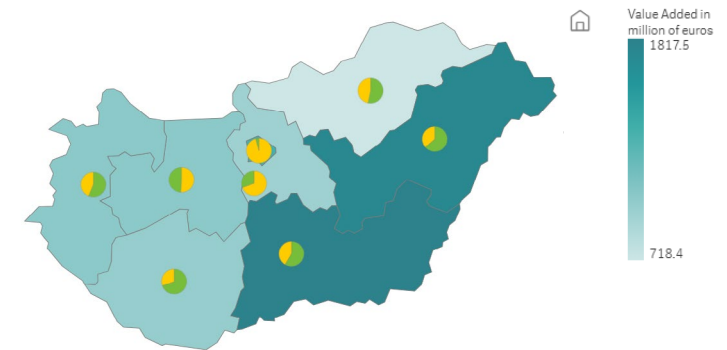
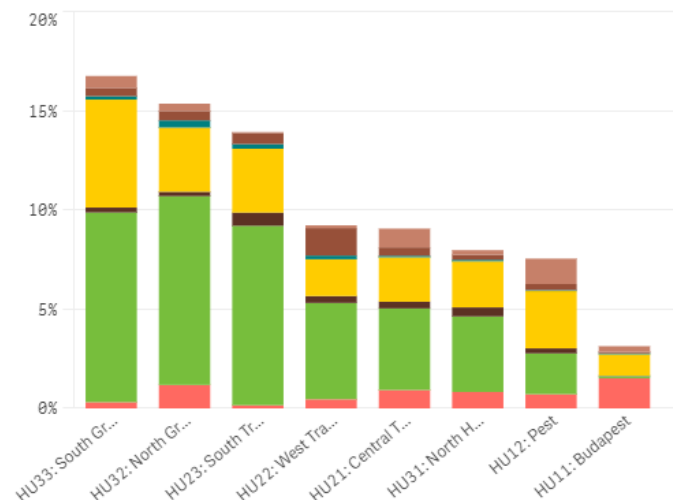
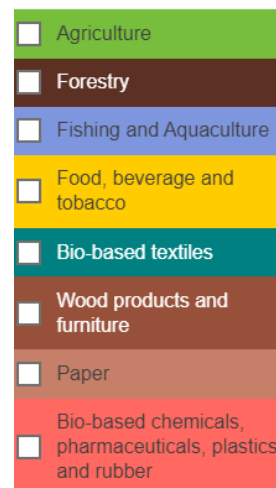


Figure 9. Contribution of the bioeconomy sectors to the total regional added value (data from BioRegEU dashboard)





4.3. Regional Strategies including reference to bioeconomy



Even if there are not dedicated regional bioeconomy strategies in Hungary, some territorial development strategies are referring to aspects which are relevant for future bioeconomy development.

Table 15. Regional strategies relevant for bioeconomy

NUTS-3 area (county)	Code	Aspects of the strategy linked to bioeconomy
Pest Strategic Development Program 2021-2027	HU120 in Pest	The income-generating capacity of agriculture and the food industry is one of the most important development goals of the region. Developing food processing capacities and improving access to markets (especially for exports) are crucial for the region. The productivity of agriculture need be enhanced, the processing industry developed, short supply chains established, and local raw materials used to form an efficient agrarian vertical capable of producing high added value. Bio-waste should be also valorised generating biogas.
Komárom-Esztergom Strategic Development Program 2021-2027	HU212 in Central Transdanubia	The plan emphasises that the development of industries related to bioeconomy, including agriculture, forestry, biomass utilization, bio-based products, biotechnology, and renewable energy sources like biofuels and biogas, is essential for sustainable economic growth and environmental preservation. The county supports R&I in the fields of biotechnology, nanotechnology, and environmental sciences to foster sustainable development and enhance local competitiveness. The expansion of forestry and forest management practices is a key pillar in combating climate change and promoting biodiversity. The waste management system includes measures to enhance composting, promoting organic waste recycling and energy recovery. Sustainable management of wood resources, including wood processing industries, are considered key to achieve both economic and environmental goals.
Győr-Moson-Sopron Strategic Development Program 2021-2027	HU221 in West Transdanubia	The plan supports bio-waste management through composting and recycling initiatives, including biogas production. In terms of bio-based products, it is recognized that biofertilisers and other bio-based agrochemicals play an important role in circular agricultural systems. The plan considers essential to support afforestation and the creation of green spaces in settlements.
Baranya Strategic Development Program 2021-2027	HU231 in South Transdanubia	Improving food self-sufficiency and the increase of agricultural and food industry storage capacities in rural areas is considered strategic. Moreover, the development of water, sewage, waste, and bio-waste treatment infrastructure in rural settlements are also prioritize supporting zero-waste production models.



Table 15. Regional strategies relevant for bioeconomy

NUTS-3 area (county)	Code	Aspects of the strategy linked to bioeconomy
Somogy Strategic Development Program 2021-2027	HU232 in South Transdanubia	The plan emphasises that the development of industries related to bioeconomy, including agriculture, forestry, biomass utilization, bio-based products, biotechnology, and renewable energy sources like biofuels and biogas, is essential for sustainable economic growth and environmental preservation. The county supports R&I in the fields of biotechnology, nanotechnology, and environmental sciences to foster sustainable development and enhance local competitiveness. The expansion of forestry and forest management practices is a key pillar in combating climate change and promoting biodiversity. The waste management system includes measures to enhance composting, promoting organic waste recycling and energy recovery. Sustainable management of wood resources, including wood processing industries, are considered key to achieve both economic and environmental goals.
Tolna Strategic Development Program 2021-2030	HU233 in South Transdanubia	The plan intends increasing agricultural energy efficiency, primarily through measures such as rainwater and river water management. Moreover, the county intends to target agricultural raw material- high value-added production from agricultural biomass, by increasing forms of cooperation among producers in processing, selling and marketing activities. It is considered key to applying nature-based solutions, promoting organic farming, promoting agri-environmental management, and spreading education in natural environments (forest school) to ensure long-term sustainable development.
Heves Strategic Development Program 2021-2027	HU312- North Hungary	It is emphasised that the challenges in agriculture, such as climate anomalies and changes in the production environment, can be alleviated through precision technologies. The key issue in local agricultural economy includes the organization level of farmers (market participation). Increasing the market orientation of producers can be achieved by encouraging participation in producer groups. This would allow scale economies on the production side and, through unified marketing efforts, enhance competitiveness and exploit market gaps. The program supports the management and local recycling of biodegradable and green waste, including the promotion of household and community composting. Wood raw materials, as well as agricultural waste, have significant future potential for utilisation.
Nógrád Strategic Development Program 2021-2027	HU313 in North Hungary	A key goal within the program is the modernisation of agricultural activities and increasing competitiveness of agri-food sector. The food industry has traditions (e.g. Házikó Farm, Cafe Frei Ltd.'s roasting plant, pumpkin seed oil production), and related packaging machine manufacturing is also present. Food processing plays a key role in the economic development of the Szécsény district. Supporting the production and sale of local foods is considered strategic to promote healthy eating for the county's population. The utilisation of agricultural by-products and waste (biogas, biomass) is seen as a priority as well.
Hajdú-Bihar Strategic Development Program 2021-2027	HU321 in North Great Plain	The strategy highlights the priority to use of biomass waste from agriculture and forestry and promotes the composting of this waste to replace chemical fertilisers, thus contributing to environmental sustainability. Increasing the application of precision technology and utilising agricultural by-products. The plan emphasises the need to increase the competitiveness of local agricultural production in creating healthy, high-value food products. The strategy highlights the need for sustainable land use, including increasing forest coverage, with a focus on native species. Wood by-products from forestry are included in plans for biomass use. There is a focus also on increasing the use of biomass, biogas, and geothermal energy. Paper waste management is part of the region's circular economy, with selective waste collection systems including paper, and promoting its recycling and reuse.
Bács-Kiskun Strategic Development Program 2021-2027	HU331 in South Great Plain	The plan prioritises the sustainable use of biomass and bio-based resources, derived from agriculture, forests, and wood, for the production of various bioproducts through biotechnology, including paper, pulp, biogas, compost, and biofuels. By harnessing these resources, the territory can significantly reduce waste and promote circular economies. Furthermore, promoting bio and ecological production, alongside the development of waste recycling and utilisation systems, plays a pivotal role in achieving environmental sustainability.



5.

BIOMASS CURRENT USE AND POTENTIALS

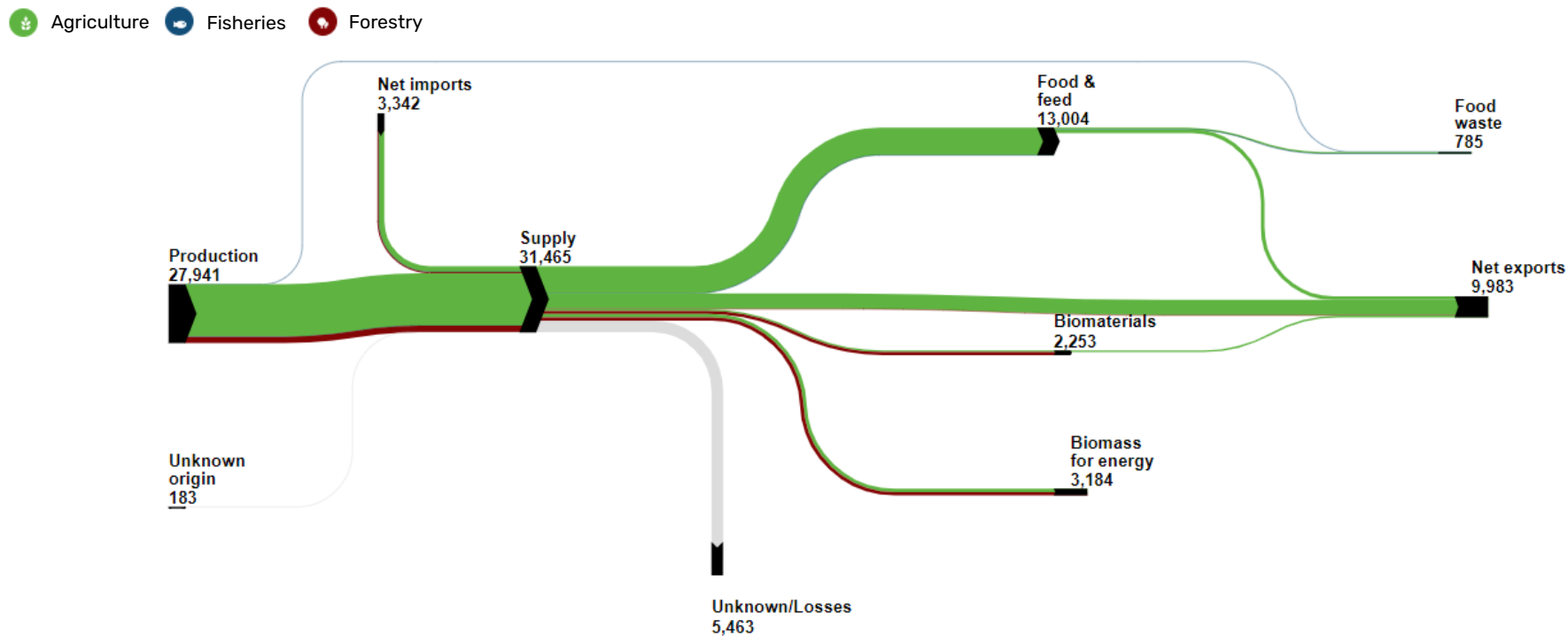
5.1. Current use of biomass

From the Sankey diagramme for Hungary, the following main observations can be made (quantities are all expressed in million tons of dry matter). The main biomass supply produced in Hungary is from crops, crop harvested residues, primary woody biomass and grazed biomass. Most of the agricultural biomass is used for food and feed products and the woody biomass is

mostly converted to heat and power and bio-materials.

The largest export volume are plant products and plant based food. Processed products from crop fibres are mostly exported. Imports consist mostly in volume of animal products.

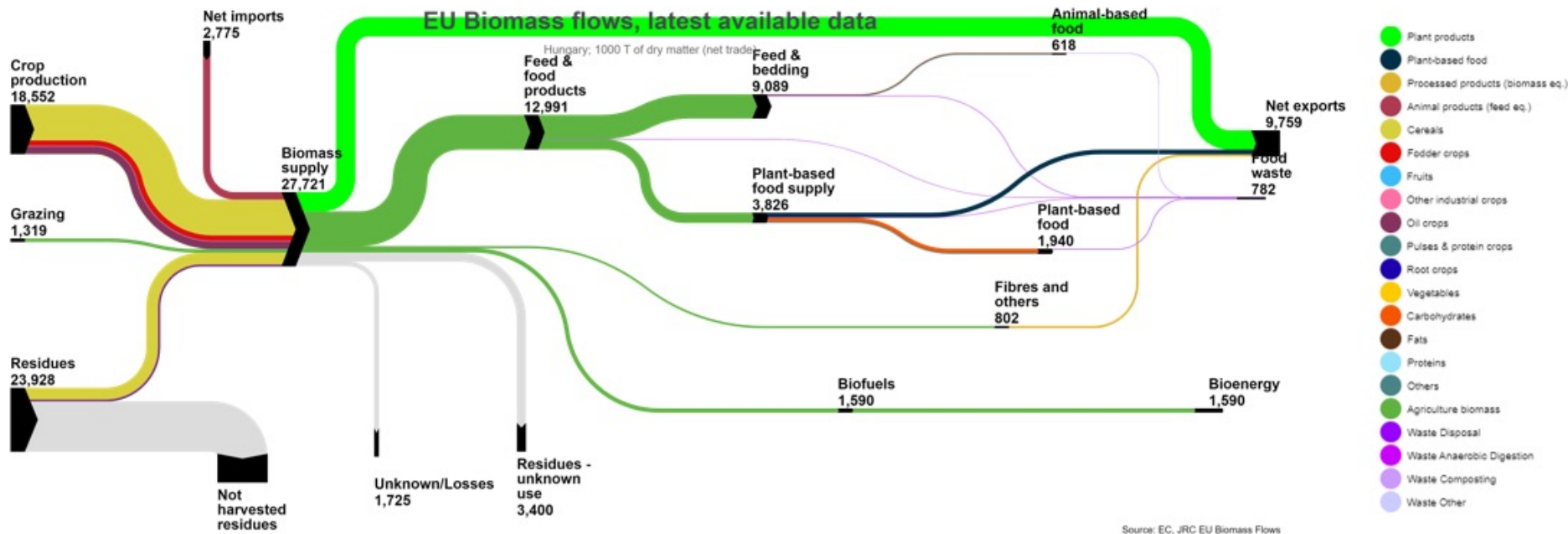
Figure 10. Sankey diagramme on biomass use (agriculture and forestry) in Hungary ³



³ Sankey diagramme, last update 2023, Source: data from the BIOMASS project, European Commission – Joint Research Centre. The data point “Latest available data” corresponds to the latest data available from each sector: 2020 for agriculture, 2016 for fisheries and aquaculture and 2017 for forestry.



Figure 11. Sankey diagramme on biomass use (focus on agriculture) in Hungary⁴



⁴ Sankey diagramme, last update 2023, Source: data from the BIOMASS project, European Commission – Joint Research Centre. The data point “Latest available data” corresponds to the latest data available from each sector: 2020 for agriculture, 2016 for fisheries and aquaculture and 2017 for forestry.



5.2. Biomass potential (residues and waste)



Considering the high vocation of the country in agriculture and food production, a significant amount of residual biomass is available for potential further valorisation into bio-based value chains.

The potential amount from different biomass origins have been estimated in literature⁵ within the BBI-JU project CELEBIO (partner from Hungary the **Regional Centre for Information and Scientific Development**).

This type of biomass is sufficient for being valorised both into biogas/bioenergy and to produce bio-based chemicals, materials and/or products with higher added value following an integrated biorefinery approach.

Focus on bio-waste as defined by the Waste framework Directive (food waste and garden waste)

According to a recent publication from **BIC and Zero Waste Europe**, the theoretical potential of bio-waste generation (including both food and garden waste) in Hungary is around 2.3 million tons/year with a current capture of 16%.

The collected bio-waste are mainly constituted by garden waste for which door-to-door collection is the dominant system in cities, towns and suburbs, and

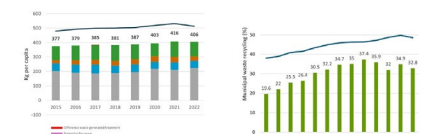
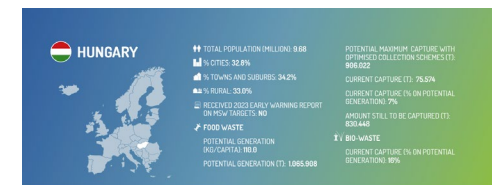
rural areas. For food waste, separate collection scheme is under development (current capture of 75,574 tons/y).

While prioritising the prevention of food waste generation according to waste hierarchy, there is still large untapped potential to collect and valorise urban bio-waste in Hungary to produce high quality compost, biogas/ biomethane in combination with additional added value bio-based products.

Table 16. Estimated potential from residual biomass in Hungary (data from Celebio BBI-JU project)

	Estimated potential
Lignocellulosic residual biomass from crops	<ul style="list-style-type: none"> → 9927 kton d.m.* /y from rice straw, cereals straw, oil seed rape straw, maize stover, sunflower straw of which 2000 kton d.m./y are already used in livestock sector → 130.6 kton d.m./y from residues from fruit tree plantations
Manure	→ 10.8 million ton/y of collectable manure
Side products from agri-food processing	→ > 500 kton d.m./y
Secondary biomass potential from forests	→ 626 kton d.m./y including sawdust, residues from industries producing semi-finished wood based panels and residues from further wood-processing

*d.m stands for dry matter



⁵ Deliverable 2.1 "Country Report Hungary"- Celebio project. This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 838087



CORE INTERREG PROJECT

CORE intends to be an accelerator for rural territories to develop composting a lot more so that in the mid-term the organic fraction and the effects associated to it could drastically decrease.

The project brings together regional and local administrations with competences on bio-waste management from eight rural regions from all over Europe, with the aim of exchanging their experiences on composting. The European Compost Network (ECN) accompanies them in the role of advisory partner.

Contrary to previous projects that focused on the prevention of food waste and some composting experiences, CORE focuses on composting in rural environments, paying particular attention to the particularities of the topic in these scenarios.

The main goals of the project are:

- ➔ Mainstreaming compost in rural areas
- ➔ Develop best practices to support bio-waste management in rural areas
- ➔ Furthering the goal of a circular bio-economy

Participant from Hungary is CTRIA - Central Transdanubian Regional Innovation Agency Nonprofit Ltd.

5.3. Marginal lands

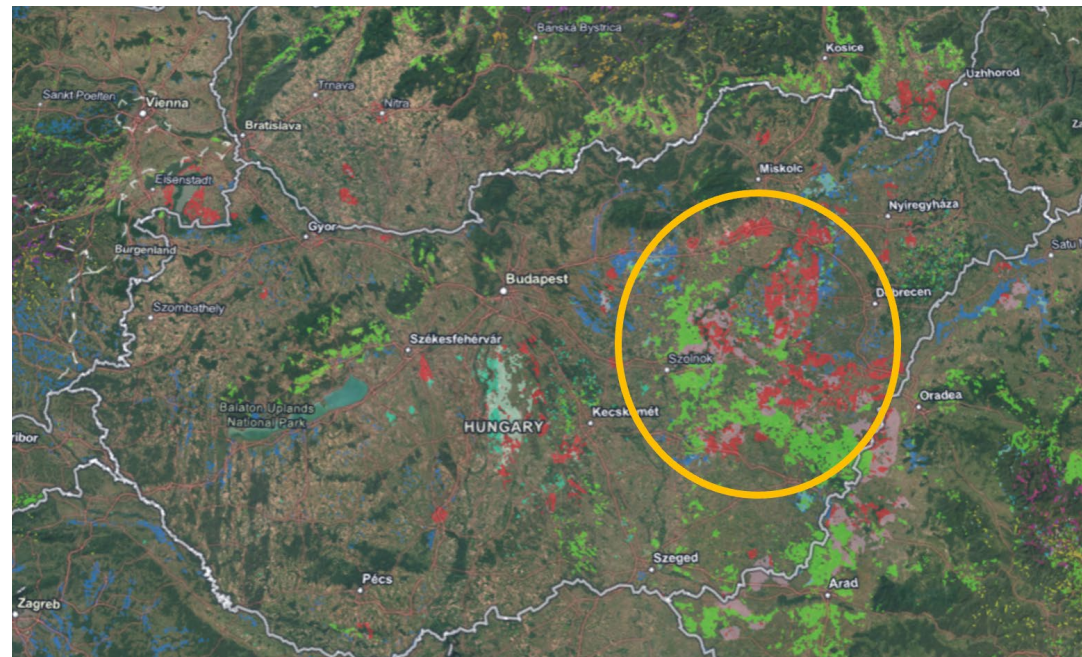
Within the Horizon 2020 project **MAGIC** and Horizon Europe **MIDAS**, a map of EU marginal lands which could be valorised for industrial crops establishment using sustainable agricultural practices has been elaborated.

In Hungary, as visible in the map, most of the marginal lands are concentrated in the Central Eastern are of the country (points in green and red). The reasons for marginality are mainly related to the following factors: i) in green, the

areas with limitations in rooting conditions ii) in red, the areas affected by adverse chemical conditions either for the excess of salts (salinity or sodicity) or toxic elements in the soil.

Marginal lands could be valorised in the perspective of future biorefineries establishing win-win cooperation model between farmers and industries, providing additional sources of income to primary sector while contributing to soil regeneration and an increase in green jobs.

Figure 12. Map of marginal lands in Hungary 2020





6.

R&I ECOSYSTEM AROUND BIOECONOMY

According to the European Innovation Scoreboard, Hungary belongs to the group of 'Moderate Innovators' in 2024, with a performance of 70.5%. Compared to the EU average, Hungary has lower per capita income but a faster growing economy with a high share of non-innovators with the potential to innovate.

Since 2017, Hungary's framework conditions have seen notable improvements. Human resources have improved, with an increase in new doctorate graduates in STEM (+11.6% points) and significant growth in lifelong learning (+37.7% points).

Digitalisation efforts have also advanced, with substantial improvements in broadband penetration (+43.3% points) and basic digital skills among the population that surpasses the EU average.



These improvements run in parallel with programmes like the Digital Transition of Higher Education and Digital Welfare Programme, which focused on digital transformation, ICT infrastructure, skills, teaching and learning.

Compared to 2017, there have been dramatic improvements in the linkages between Hungarian research actors (+55.1% points overall), with notable growth in innovative SMEs collaborating with others, public-private

co-publications, and job to-job mobility of highly skilled professionals, that are now 73.1%, 117.3%, and 97.9% of the EU average.

This progress has been aided by initiatives such as the Széchenyi 2020 programme which supported projects which targeted business process innovations and that strengthen linkages between SMEs and research institutions.

6.1. National R&I priorities and relevant funding schemes

Hungarian R&I strategy for 2021-2030

The vision of Hungary's RDI strategy for 2021-2030 is a knowledge-based, balanced, sustainable economy and society capable of creating high added value in all areas of the country, a vision supported by the Government through the instruments of RDI policy.

The RDI policy aims to put Hungary among the strong innovator countries in the EU by the end of the decade, through the value-creating capacity of the RDI ecosystem, intensive improvement of the innovation performance of the business enterprise sector and consistent implementation of smart specialisation. To this

end, the Government has committed in its RDI strategy to increase R&D expenditure as a share of GDP to 3% by 2030.

To achieve the government goals, competitiveness needs to be enhanced with a high value-added, innovation-open economy and a business enterprise sector that uses and develops modern technology and is able to respond flexibly to world developments.

The RDI Strategy sets out three main overarching objectives for RDI policy in Hungary:

- Making more use than at present of the research results of public research institutions (research institutes and higher education institutions).



- Improving the innovation performance of domestic enterprises, especially small and medium-sized enterprises.
- Strengthening cooperation between actors in the R&D and innovation system.

The objectives of the RDI strategy are structured around three main pillars, as outlined above:

- Strengthening knowledge production by expanding and modernising the capacity of the RDI institutional system and ensuring a supply of researchers.
- Enhancing knowledge flows by encouraging more effective cooperation between actors in the RDI ecosystem, increasing interoperability between sectors and expanding opportunities for knowledge transfer.
- Making better use of knowledge by boosting innovation.

S3 Smart Specialisation Strategy

In coherence with this plan, the S3 Smart Specialisation Strategy is focused on the following priorities:

- **Cutting-edge technologies**
- **Health**
- **Digitisation of the economy**
- **Energy, climate**
- **Services**
- **Resource-efficient economy**
- **Agriculture, food industry**
- **Creative industry**

Bioeconomy is recognised to play a relevant role especially under agriculture and food industry and resource-efficient economy priorities.

In particular, targeted innovation in agri-food value chains include: *forestry, horticultural technologies, plant breeding, plant protection, crop production technologies; animal breeding, animal husbandry, animal feed and grassland management; agri-biotechnology (soil fertilisation, irrigation, water retention, soil protection, plant biotechnology), food safety, processing technology solutions and healthy food.*

Relevant funding programmes

All these priorities are supported by funding programmes aimed at supporting innovative projects aligned with the national policy strategies.

- ➔ **National Research, Development and Innovation Fund** managed by NKFIH (National Research, Development and Innovation).
- ➔ **Operational Programmes managed by the Ministry for Innovation and Technology and co-funded by European Union and Hungary:**

- **Operational Programme for Environment and Energy Efficiency Plus (KEHOP Plus).** It focuses on promoting a sustainable, circular economy, primarily powered by renewable energy sources and aimed at protecting the environment and enhancing energy efficiency. The programme supports also the reduction of emissions in carbon-intensive regions, such as Baranya, Borsod-Abaúj-Zemplén, and Heves, while creating new jobs. It is financed by both the European Regional Development Fund (ERDF) and the Just Transition Fund (JTF), with a total public budget for 2021-2027 exceeding €4.3 billion.
- **Operational Programme for Economic Development and Innovation Plus (GINOP Plus).** It is Hungary's key instrument for fostering economic competitiveness and innovation in the 2021-2027 period. It builds upon the earlier GINOP programme and is aimed at supporting Hungarian small and medium-sized enterprises (SMEs), enhancing their technological innovation, productivity, and global competitiveness. With more than €6.1 billion budget for 2021-2027.
- **Operational Programme for Digital Agenda for Renewal Plus (DIMOP Plus)** - it is a key Hungarian programme for the 2021-2027 period, focusing on improving Hungary's digital capabilities and competitiveness (including green high-tech transition). The total public budget is around €2 billion.



6.2. Hungary in Horizon 2020 and Horizon Europe programme



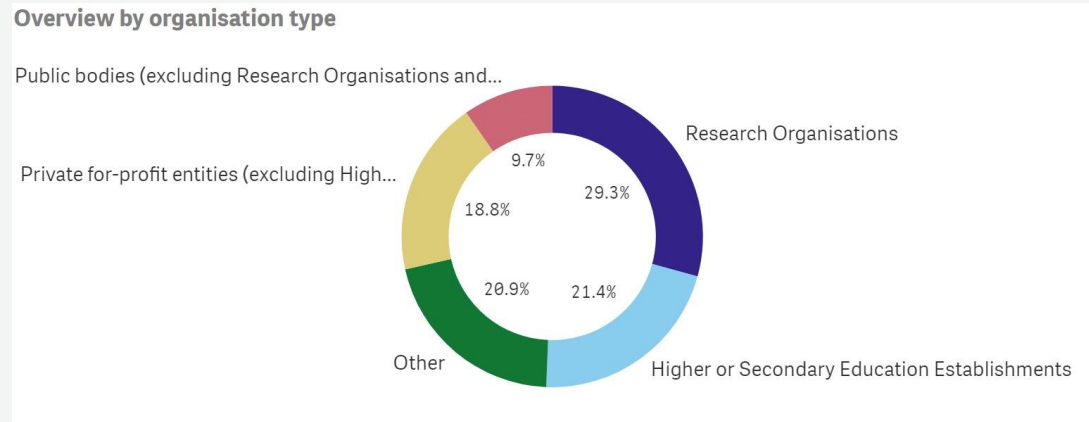
Hungary is a modest actor with reference to participation in co-funded projects under H2020 and Horizon Europe programmes (available data until the end of the 1st cycle of Horizon Europe programme)⁶; it is considered as a widening country with lower R&I performances and participation in EU co-funding programmes with 1,681 signed grants and a net EU contribution of €548.2 million.

Focusing on bioeconomy⁷, according to data from the Horizon dashboard and in-depth analysis from the Cordis database, the key facts and figures related to Hungary's bioeconomy have been retrieved. Some 252 bioeconomy related projects have been funded with a net EU contribution of €63.9 million.

The total number of projects distribution have been clustered per focus area revealing that the highest number of projects are focusing on developing strategy, policy, governance and networking (33%) followed by sustainable rural practices mainly in agricultural field and biodiversity (22%), food and feed sustainable production and consumption patterns in alignment with Farm2Fork strategy (14%) as well as on circular and bio-based chemicals, products and materials including novel food and feed ingredients (12%).

A number of projects classified as other include advanced digitalisation tools applied to bioeconomy value chains, microbiome, restoration of ecosystem services.

Figure 13. Overview by organisation type



⁶ Some proposals under closed call for proposals are still under evaluation among which CBE-JU proposals submitted in response to AWP 2024 topics

⁷ Priorities: "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy", "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy" and "Biotechnology"



Figure 14. Share of bioeconomy related projects in Horizon 2020 and Horizon Europe per focus R&I area

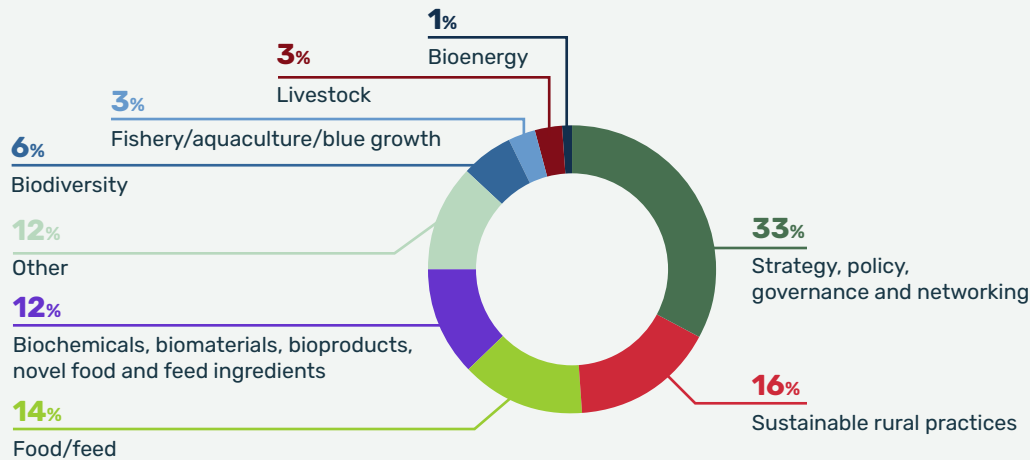
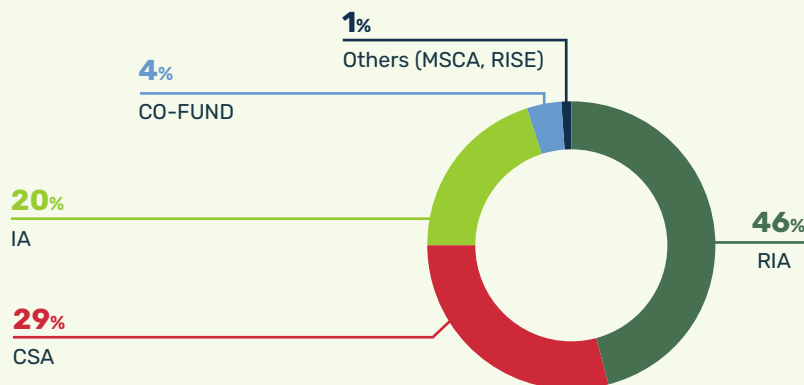


Figure 15. Share of bioeconomy related projects in H2020 and Horizon Europe projects per type of action



75% of the bioeconomy related projects are RIA and CSAs, highlighting the focus on one side on developing/expanding networks and partnerships, strategies and knowledge transfer activities to support bioeconomy growth, and on the other side, to implementing low TRL activities to develop more research focused technologies and practices with potential to be further scaled-up in relevant industrial environment by involving more and more industries (including local SMEs, spin-off and start-ups).

Figure 16. Number of related projects in Horizon 2020 and Horizon Europe per focus R&I area

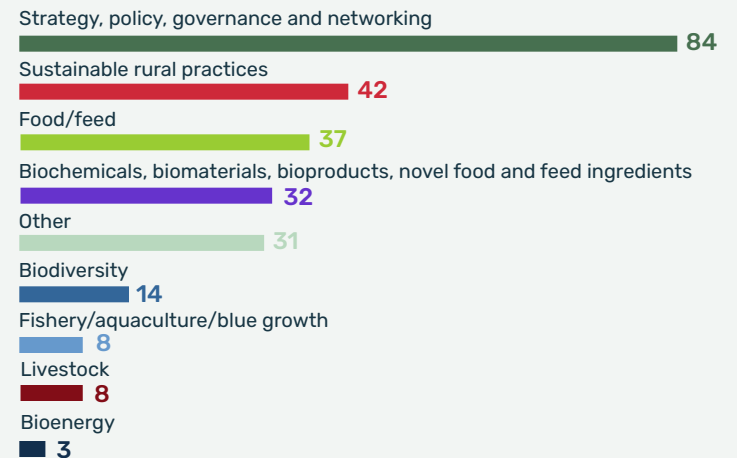


Figure 17. Number of related projects in Horizon 2020 and Horizon Europe per type of action

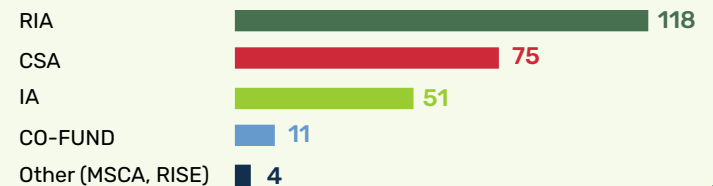




Table 17. Participation in BBI and CBE-JU projects

Acronym and call	Type	Project coordinator & Duration	Beneficiaries from Hungary
<p>AgriMax IA- DEMO <i>BBI.VC3.D5-2015 - Valorisation of agricultural residues and side streams from the agro-food industry</i></p>	<p>Agri and food waste valorisation co-ops based on flexible multi-feedstocks biorefinery processing technologies for new high added value applications</p>	<p>IRIS TECHNOLOGY SOLUTIONS 1 October 2016 - 30 September 2021</p>	<p>LASER CONSULT MUSZAKI-(SME)-Innovation consulting</p>
<p>POLYBIOSKIN RIA <i>BBI-2016-R07 - Biopolymers with advanced functionalities for high performance applications</i></p>	<p>High performance functional bio-based polymers for skin-contact products in biomedical, cosmetic and sanitary industry</p>	<p>IRIS TECHNOLOGY SOLUTIONS 1 June 2017 - 31 July 2020</p>	<p>LASER CONSULT MUSZAKI-(SME)-Innovation consulting</p>
<p>Dendromass4Europe IA-DEMO <i>BBI-2016-D09 - Biomass production on unused land for conversion into added-value products while 'boosting rural and industrial development'</i></p>	<p>Securing sustainable dendromass production with poplar plantations in European rural areas</p>	<p>TECHNISCHE UNIVERSITAET DRESDEN 1 June 2017 - 30 November 2022</p>	<p>OKOFORSTINO KORLATOLT FELELOSSEGUTARSASAG Sopron (SME)- Forest management company</p>
<p>FARMYNG IA- FLAG <i>BBI.2018.S03.F2 - Large-scale production of proteins for food and feed applications from alternative, sustainable sources</i></p>	<p>Flagship demonstration of industrial scale production of nutrient resources from mealworms to develop a bioeconomy new generation</p>	<p>YNSECT 1 June 2019 - 30 June 2025</p>	<p>AGRO-MULTIFOOD Kft. (SME)- agri-food company</p>
<p>CELEBio CSA <i>BBI.2018.S04.S2 - Expand the bio-based industry across Europe</i></p>	<p>Central European leaders of bioeconomy network</p>	<p>INCE INIZIATIVA CENTRO EUROPEA 1 June 2019 - 30 November 2020</p>	<p>REGIONALIS INFORMACIOS ES FEJLESZTO TUDASKOZPONT KORLATOLT FELELOSSEGU TARSASAG - Regional Information and Development Knowledge Center (private for profit entity)</p>
<p>LANDFEED IA-DEMO <i>HORIZON-JU-CBE-2023-IA-02 - Production of safe, sustainable, and efficient bio-based fertilisers to improve soil health and quality</i></p>	<p>Unlocking efficient bio-based fertilisers for soil sustainability from underutilised side streams</p>	<p>NEIKER 1 September 2024 - 31 August 2028</p>	<p>LASER CONSULT MUSZAKI-(SME)-Innovation consultant</p>



6.3. Academia and research centres relevant to bioeconomy

Universities

→ Budapest University of Technology is the biggest university in Hungary with a dedicated Faculty of Chemical Technology and Biotechnology developing R&I projects in the field of inorganic and organic chemistry, pharmaceutical innovation, process engineering, biotechnology, health and environment protection, food related topics, nanotechnology, material sciences, development of polymer composites. Some projects encompass the development of bio-based chemicals and materials (e.g. **bio-based resins for aeronautical applications** within Clean-Sky JU project bio-composites and others).

Additional interesting H2020 and Horizon Europe projects within the University are

- **CO2EXIDE-CO2-based Electrosynthesis of ethylene oXIDE**;
- **BEAMING-Bioeconomy Excellence Alliance For Stimulating Innovative And Inclusive Green Transition** focused on fostering collaboration, implementing structural reforms, and promoting a culture of innovation in the bioeconomy domain within Widening Countries;

- **IPPT Twin-Reinforcing the scientific excellence and innovation capacity in polymer processing technologies of the faculty of polymer technology**;
 - **DESIRE4EU-DESIGNing and REcycling sustainable Electronic boards for a European circular economy**, focusing on bio-based materials for electronic applications;
 - **BOOST4BIOEAST** - aiming at connecting bioeconomy stakeholders with policy makers through national expert communities (BIOEAST HUBs) to strengthen their engagement in bioeconomy policy, research and innovation. To that aim, the project will develop national bioeconomy action plans and set up long-lasting structures for cooperation and networking at national and macroregional level;
 - **PROCRYSTAL**- Crystallisation towards efficient and sustainable biomanufacturing;
 - **GREEN-MAP** focused on novel bio-based, biodegradable polymers that can be used in medical device packaging as well as for disposable medical devices/components.
- Corvinus University of Budapest which is best known for its studies of business and economics including studies on bioeconomy. It is currently coordinating the Horizon 2020 project **TRADE4SD**

focused on studying the relationship between trade and sustainable development in agricultural sector and policy provide recommendations for a more sustainability-oriented agricultural trade.

→ Central European University (CEU) with strong MBA programmes and even an accelerator that won the title of the Best Accelerator and Incubator in Hungary.

→ Hungarian University of Agriculture and Life Sciences is the leading research and innovation in agricultural field in Hungary with a high participation in Horizon 2020 and Horizon Europe projects. Relevant to bio-based products for agriculture, it is worth mentioning the EU projects:

- **NeoGiants-The power of grape extracts: antimicrobial and antioxidant properties to prevent the use of antibiotics in farmed animals**,
- **iFishIENCi- Intelligent Fish feeding through Integration of ENabling technologies and Circular principle**,
- **LEX4BIO- Optimizing Bio-based Fertilisers in Agriculture – Knowledgebase for New Policies**,
- **ECOBREED- Increasing the efficiency and competitiveness of organic crop breeding**



→ University of Debrecen in North Great Plain has a strong background in R&I within the automotive engineering (mainly through the collaboration with Audi Hungaria Motor Kft). Regarding bioeconomy R&I, the Faculty of Agricultural and Food Sciences and Environmental Management is concentrated around the accredited doctoral schools in crop production, horticulture, animal husbandry, nutrition and food sciences.

→ Széchenyi István University, and particularly the Faculty of Agricultural and Food Sciences Mosonmagyaróvár. Among the relevant EU projects related to bioeconomy:

- **SABANA- Sustainable Algae Biorefinery for Agriculture and Aquaculture; ClimateSmartAdvisors- connecting and mobilizing the EU agricultural advisory community to support the transition to Climate Smart Farming;**
- **Trans4num- Transformation for sustainable nutrient supply and management;**
- **ClimateSmartAdvisors: Connecting and mobilizing the EU agricultural advisory community to support the transition to Climate Smart Farming;**
- **Climate Farm Demo- A European-Wide Network Of Pilot Farmers Implementing And Demonstrating Climate Smart Solutions For A Carbon Neutral Europe**

→ University of Sopron, and particularly the Faculty of Forestry focused on sustainable forest management; relevant to this field the Horizon Europe project **REFOREST- Agroforestry at the forefront of farming sustainability in multifunctional landscapes in Europe.**

→ University of Pannonia with competences on bioeconomy, particularly within environmental engineering, environmental sciences and water and wastewater treatment system operations.

→ University of Obuda with a dedicated biotech centre focused on biomedical engineering.

- **VISIONARY- Food Provision through Sustainable Farming Systems and Value Chains;**
- **modernAKIS- Modernisation of Agriculture through more efficient and effective Agricultural Knowledge and Innovation Systems;**
- **CLEVER FOOD- Connected Labs for Empowering Versatile Engagement in Radical Food system transformation.**

Research centres

The Institute of Agricultural Economics (AKI) is a private research centre supervised by the Hungarian Ministry of Agriculture with extensive agricultural economics databases and significant policy expertise in Hungary and Central and Eastern Europe. One of the main tasks of the Institute is to develop recommendations for agricultural, environmental and rural policy decision-makers, focusing especially on the implementation and evaluation of the European Union's Common Agricultural Policy (CAP).

As a leader in the digitalisation process of Hungarian agriculture, AKI operates and is engaged in the further development of EU and national agricultural information systems i.e., the Farm Accountancy Data Network (FADN), the Market Price Information System (MPIS), and the Agricultural Statistical Information System (ASIS). AKI has considerable experience in national and international research collaborations (H2020, HE) and is a key partner in the BIOEAST network.

Among relevant projects beyond BIOEAST in H2020 and Horizon Europe:

- **POWER4BIO- Empowering Regional Stakeholders For Realising The Full Potential Of European Bioeconomy;**

Bay-Zoltan Ltd is a not-for profit R&I organisation cooperating with public, academics, higher education institutions and their research centres and acting as a link between innovation through applied research and development and technology transfer. As a think tank with a strong team of researchers and experts, the mission is to meet the research and development needs of the industry from an idea's conception to its realisation at a high level of expertise. They are actively participating in building international consortia, networking, and EU tenders in the field of R&D and innovation. Moreover, they offer business development services as a technology incubator.

Within the institute, three departments are relevant to the bioeconomy sector- BAY-BIO focused on algae biomass technologies (fertiliser, feed), agrobiotechnology, environmental biotechnology (sensors, monitoring systems), application of microbiological technologies in food industry, molecular biology diagnostics, bioremediation and automated fermentation; BAY-ENG developing applied research in structural and functional materials; coating and surface technologies; material testing methods; numerical modelling & design of engineering structures; numerical modelling& investigation of the degradation processes of structural materials; operational safety and life cycle analysis.



Relevant bioeconomy projects in Horizon 2020 and Horizon Europe:

- **MarginUp- Raising the bio-based industrial feedstock capacity of Marginal Lands;**
- **Waste4Soil- Turning food waste into sustainable soil improvers for better soil health and improved food systems;**
- **Engage4BIO- better understanding, intensified engagement, training and development in regional bio-based systems.**

HUN-REN Biological Research Centre, Szeged- focused on R&I in biophysics, biochemistry, genetics and plant biology. Its research topics include numerous fields in molecular and cell biology, and range from the industrial applications of bacteria, through the controlled improvement of crops, to the problems of human health and environmental protection. Relevant bioeconomy projects in Horizon 2020 and Horizon Europe: **ALGAE4IBD – Algae Based Bio Compound For Prevention And Treatment Of Inflammation, Pain And Ibd.**

ÖMKi – the Hungarian Research Institute of Organic Agriculture- established in 2011 to promote the improvement and more widespread implementation of organic agriculture in Hungary. It is involved in different Horizon 2020 and Horizon Europe projects among which for example **OrganicYieldsUP- Improving yields in organic cropping systems.**

HUN-REN Centre for ecological research with the main mission is to conduct high-quality research on biodiversity and ecosystems, including aquatic and terrestrial life.

6.4. National and international bioeconomy clusters and associations

BIOEAST Initiative

BIOEAST is a Central-Eastern European Initiative for Knowledge-based Agriculture, Aquaculture and Forestry in the Bioeconomy. This initiative offers shared strategic research and innovation framework for working towards sustainable bioeconomies in the Central and Eastern European (CEE) countries.

To build sustainable national bioeconomies, the specific challenges arising from climate change in the Continental Biogeographical Region, and the macro-regional perspective, along with more vigorous European Union (EU) wide cooperation, is fostered by BIOEAST for implementing in an effective and efficient way tailored actions that are conducive to safe, secure and sustainable development for all.

Beyond Hungary, other CEE countries involved in the initiative are: Bulgaria, Croatia, Czechia, Estonia, Lithuania, Latvia, Poland, Romania, Slovakia, Slovenia, and observer from Western Balkan countries. The BIOEAST Initiative's National Contact Point (NCP) in Hungary is the Ministry of Agriculture. One of the NCP's main roles at national level is to interact and coordinate the national views with other bioeconomy related ministries.

Beside the political level, the BIOEAST is organised in different thematic working groups (TWG), each coordinated by a specific advisor entity with a deep knowledge and expertise in the sector.

The following TWGs are coordinated by Hungary:

- The TWG on “Agroecology and Sustainable Yields” is coordinated jointly by the Hungarian Ministry of Agriculture (HuMA) and the Research Institute of Organic Agriculture (ÖMKi) in Hungary.
- The TWG “Advanced Bio-based Chemicals and Materials” is coordinated jointly by the Hungarian Ministry of Agriculture (HuMA) and the Budapest University of Technology and Economics (BUTE).

Other TWGs:

- The TWG “Bioenergy & new value-added materials” is coordinated by Energy Institute Hrvoje Požar from Croatia
- The TWG “Bioeconomy education and skills” is coordinated by BIOEAST HUB from Czech Republic
- The TWG “Food systems” is coordinated by Ministry of Agriculture and Rural Development and Polish Academy of Sciences from Poland



- The TWG “Forestry value chain” is coordinated by National Forest Centre from Slovakia
- The TWG “Freshwater based bioeconomy” is coordinated by BIOEAST HUB from Czech Republic.

Hungarian Bioeconomy Cluster

It is the **national Bioeconomy Hub of Hungary** founded in 2019. The mission of the cluster is to facilitate the development and long-term maintenance of Hungary’s bioeconomy (i.e., biomass-based business processes and the related innovative, strategic, social, educational and financial environment), by carrying out the activities below:

- Develop an innovative, knowledge-based economy;
- Ensure sustainable development;
- Enhance the professional cooperation of business players and research institutes;
- Conduct utilisation-focused R&D&I activities;
- Provide market presence at cluster level;
- Create cluster-level service portfolio by integrating the members’ individual or joint services, which may provide a new market opportunity for the members;
- Increase awareness in the society.

iFood Cluster

iFood Cluster brings together agri-food operators, mainly SMEs with the main mission to organise a professional community of Hungarian food industry, which can contribute to the more effective work of its members in domestic and foreign market by strengthening the cooperation with common knowledge and common interests.

The members of the iFood Cluster are domestic food production companies, service providers and suppliers related to the agri-food industry, as well as related higher education, vocational training institutions and chambers.

Many members produce high quality lactose-free, gluten-free and sugar-reduced products, as well as plant-based, alternative protein and premium quality foods.

Pannon Wood and Furniture Industry Cluster (PANFA)

PANFA was recognised in 2013 as Accredited Innovation Cluster.

Innoskart

Innoskart is a cluster with a focus on industrial and agricultural digitalisation. It is involved in direct EU projects and partnerships that support the implementation of digital systems bringing quality and efficiency leaps for domestic SMEs.

OMNIPACK

OMNIPACK is the first Hungarian Packaging Technology Cluster recognised as Accredited Innovation Cluster.



7.

EUROPEAN FINANCIAL INSTRUMENTS SUPPORTING LARGE SCALE INVESTMENTS INTO BIOECONOMY

Some more recent financial instruments are worth to be considered in the context of circular bioeconomy, working in synergy and complementarity with Circular Bio-based Europe Joint Undertaking funding framework and additional Horizon Europe funding opportunities.

Just Transition Fund (JTF)

The Just Transition Mechanism (JTM) was proposed as part of the European Green Deal investment plan to make sure that no one and no region is left behind in the transition to a climate-neutral economy. The primary goal of the mechanism is to provide support to the most negatively affected regions and people and to help alleviate the socioeconomic costs of the transition.

The mechanism was mainly established as part of the European Green Deal investment plan and within the framework of cohesion policy (for pillars I and III), the main EU policy instrument to reduce regional disparities and to address structural change in Europe's regions.

The mechanism aims at alleviating the economic and social cost of the transition towards climate neutrality. It has three pillars. The first is the **Just Transition Fund (JTF)**. The second is the dedicated just transition scheme under InvestEU. The third is the Public Sector Loan Facility (PSLF).

According to the JTF regulation, **only areas identified for support in the territorial just transition plans** included in the adopted programmes can receive support from pillar I, amounting to €19.3 billion. It is implemented through shared management in close cooperation with national, regional and local authorities and stakeholders. This ensures ownership of the transition strategy and provides the tools and structures for an efficient management framework. The Directorate-General for Regional and Urban Policy leads on behalf of the Commission.

Within the period 2021-2027, over €250 million from the Just Transition Fund will support Hungarian regions most affected by the phasing out from coal and the lignite power plants. The selected areas are Baranya, Heves, and Borsod-Abaúj-Zemplén counties.

Funding will be directed to investments in low-carbon technologies supporting this phase out and the reduction of CO₂ emissions in Hungary by 10%.

Funds will also support the economic diversification of SMEs, for instance through research and innovation. The JTF will also help workers acquire new skills, support job transitions, and promote new start-ups.



Innovation Fund

The **EU ETS Innovation Fund** is one of the world's largest funding programmes for the deployment of net-zero and innovative technologies. It is one of the key tools of the European Green Deal Industrial Plan.

With an estimated budget of €40 billion from the EU Emissions Trading System between 2020 and 2030, the Innovation Fund is designed to create financial incentives for companies and public authorities to invest in advanced net-zero and low-carbon technologies, supporting Europe's transition to climate neutrality. Different sectors are addressed: hydrogen, cement, chemicals and refineries, glass, ceramics, construction, pulp and paper as well as biorefineries.

So far (October 2024), the Innovation Fund has awarded about €7.2 billion to more than 120 innovative projects across the European Economic Area (EEA) through previous [calls for proposals](#).

The Innovation Fund is implemented by the CINEA, while the **European Investment Bank (EIB)** provides the project development assistance to promising projects that are not sufficiently mature for Innovation Fund grants.

So far different projects have been funded on biofuels/biorefineries/bio-based chemicals and products and new ones are going to start from the 2023 call for proposals. Some examples from the [Innovation Fund database](#):

- FirstBio2Shipping: First Bio-LNG to Marine Shipping (Attero, Netherlands)

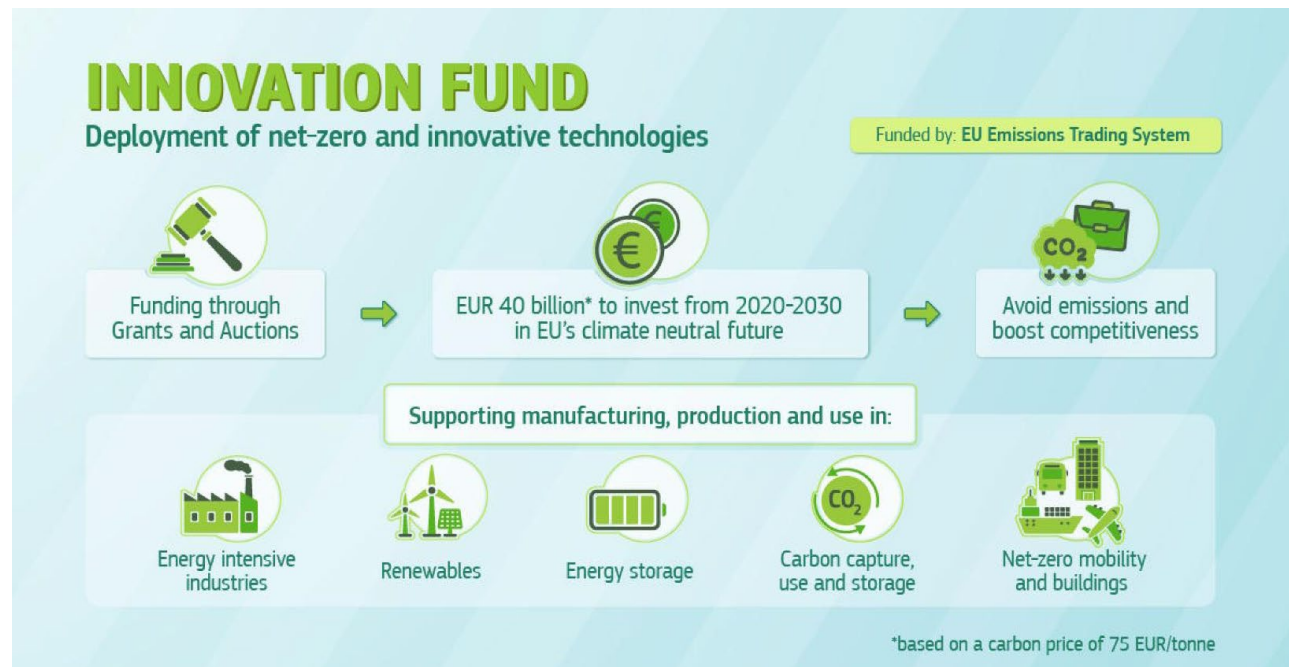


Image source above: [European Commission](#)

- FUTURE- Food waste Upcycling for Transformative Utilization in Renewable Environmental lactic acid (3PLW, Belgium)
- 3D Fibre Functional, safe, and sustainable 3D wood fibre-based packaging innovation to replace plastics in food and food service packaging (METS SPRING OY, Finland)
- BACCO- Biofiller Agro-industrial Can Change hOrizon (TAMPIERI FINANCIAL GROUP SPA, Italy)
- L1X- Unlocking a bio-based future by turning globally available waste biomass into renewable building blocks (LIXEA SWEDEN AB, Slovakia)
- TLP- Thermoplastic lignin production - Creating a green industry to replace fossil-based plastics (Lignin Industries A.B., Sweden)
- AMBASSADOR: closed-loop installation for sustainable production of bioMethane, BioCO2 And biofertilizerS a new StandArD for zeRo waste economy (BZK ENERGY SPOLKA Z OGRANICZONA ODPOWIEDZIALNOSCIA, Poland)
- BIOZIN: Conversion of waste and residue BIOmass from Norwegian forestry and sawmills to advanced low carbon fuels for Zero emission transportation Industry (Biozin Holding AS, Norway)



- LuGaZ: Local manUre and agri-food waste treatment for bioGAs and biofertilizers production from Zero waste and circular economy perspective (Grupo Leche Rio SA, Spain)
- BioOstrand: Biorefinery Östrand - The first commercial deployment of solid biomass-and-power-to- Sustainable Aviation Fuels technology line-up (Biorefinery Ostrand AB, Sweden)

Compared to other EU countries, the Innovation Fund in Hungary has not yet fully exploited. One project related to biogenic CO₂ capture and storage has been funded under the 2023 call for proposals (invited for Grant Agreement preparation and thus not yet started).

The project “Danube Removals” in Hungary marks the first onshore CO₂ storage (CCS) project supported by the Innovation Fund in the EU, as well as Hungary’s first commercial-scale CCS project. The project aims to deliver carbon removals through the capture of biogenic CO₂.

The Project is owned by Danube CCS Ventures Kft., a special purpose Hungarian limited liability company (“DCV”), and sponsored by Ireland’s ClonBio Group Limited and the UK’s EMOV Limited. With a capital cost of €80 million, and an annual operating cost of €14 million, the Project showcases the advantages of onshore saline aquifers as CCS sinks applied to biogenic CO₂ from fermentation processes (Pannonia biorefinery).

The Commission will launch the next call for proposals under the Innovation Fund in early December 2024.

European Circular Bioeconomy Fund (ECBF)

European Circular Bioeconomy Fund (ECBF) is the first venture fund exclusively dedicated to investing in growth-stage companies in the European bioeconomy, including the circular bioeconomy. Initiated by the European Union and supported by the European Investment Bank (EIB), the fund aims to make sustainable investments in our future and speed up the shift from a fossil-based to a bio-based circular economy.

Thus, ECBF backs up businesses with high potential for innovation, favourable returns, and sustainable impact. By identifying the most promising investment targets and syndicating with private and public investors, ECBF brings Europe’s circular technologies and bio-products to market. As a growth-stage venture capital fund, the ECBF offers both project financings and typical venture capital to investment targets in the EU-27 and 16-HORIZON 2020 associated countries.

Targeted industry sectors are Agri- and food, forestry, blue economy, industrial biotech, bio-based chemicals and materials, packaging, personal & home care,

construction, textiles and others. Investments are focused on companies or projects with Technology Readiness Level (TRL) of 6-9 and some first significant commercial traction. The investment size ranges from €2.5-10 million.

The portfolio of projects supported under ECBF are reported in the [projects database](#).

Currently there are no projects from Hungarian companies.

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