Presidenza del Consiglio dei Ministri

CNBBSV
COMITATO NAZIONALE PER LA BIOSICUREZZA LE BIOTECNOLOGIE E LE SCIENZE DELLA VITA

National Bioeconomy Coordination Board (NBCB)

UPDATED IMPLEMENTATION ACTION PLAN (2025-2027) FOR THE ITALIAN BIOECONOMY STRATEGY BIT II

Updated version, 16 December 2024

Summary

EXECUTIVE SUMMARY

This document is the updated version of the Implementation Action Plan (IAP) released in January 2021 (Action Plan 2020-2025 of the Italian Bioeconomy strategy BITII), in connection with the revised national Bioeconomy Strategy (BIT II) (https://cnbbsv.palazzochigi.it/en/Bioeconomy/).

The updated IAP presents:

- a detailed action plan for 2025-2027 outlining a series of relevant targeted actions clustered into 5 main Bioeconomy macro-areas;
- flagship projects that are either in progress or ready for deployment, to provide concrete examples of how circular Bioeconomy investments can serve as catalysts to strengthen and expand the primary Bioeconomy sectors;
- legislative requirements and economic opportunities;
- a plan for the dissemination and monitoring of IAP results and impacts.

The critical geopolitical landscape, marked by rising tensions and conflicts involving new geographical areas, from Ukraine to the Middle East, highlights the importance of adopting new, sustainable production, consumption and business models, including a wider utilization of renewable resources for producing chemicals, materials and energy, and the adoption of a circular approach to material use, aimed at reducing our dependency on imported resources. Furthermore, the global pandemic and the aforementioned events have revealed the necessity to integrate social, economic, technological and environmental perspectives more efficiently.

In this frame, the sustainable and circular Bioeconomy can help achieve a new equilibrium that balances all these dimensions, considering its significant economic potential, its ability to restore and regenerate natural capital and its intrinsic ability to quickly adapt and rethink the production logic, thus ensuring production stability, as well as the health and safety of communities. Sustainable Bioeconomy can also contribute to regenerative and sustainable development, fostering social cohesion and political stability in the impacted Mediterranean macro-region and Africa.

However, given the international context and the new investments in extra-EU countries such as China and USA in the manufacturing of products from biobased sources, it is crucial for Italy to fully seize the strategic opportunities already generated and under implementation in the Bioeconomy domains. The potential of Bioeconomy will be fully deployed in the Italian socio-economic system if public-private partnerships sustaining it will be strengthened, and the following strategic orientations are endorsed and implemented:

- **develop initiatives and investments** to support and interconnect all sectors of the sustainable circular Bioeconomy across the national territory, fully leveraging the potential of its significant rural, hilly, mountainous and coastal areas;
- **overcome legislative barriers** as a necessary prerequisite to support the implementation of identified Bioeconomy initiatives in the country**;**
- **promote the development and adoption of a clear, stable and harmonized legislative framework** that can truly boost the market for food and beverage, chemicals, materials, products and fuels

made from biobased feedstocks;

- **implement circular and regenerative approaches** aimed at protecting and restoring damaged ecosystems and biodiversity losses**, in line with the new EU Nature Restoration Law;**

- **promote the integration between Bioeconomy sectors** both vertically (supply chain) and horizontally (territory), **ensuring active involvement from primary producers, citizens and public administration bodies,** as well as improving skills, education and entrepreneurship.

To implement the mentioned strategic orientations, the following Actions have been identified:

1) **Launch of territorial pilot actions to support the national Bioeconomy across the agrifood, biobased, forestry, wetland, energy and marine and maritime sectors, in rural, coastal and urban areas;**
2) **Promoting the development and adoption of policies, standards, labels, certificates and emerging market-based actions, including fiscal and financial incentives, to enhance the production of innovative products and energy from all nationally available biological feedstocks, in line with the relevant EU normative;**
3) **Enhancing the knowledge as well as the monitoring, sustainable management, protection and restoration of national biodiversity, ecosystems and soils, while strengthening their contribution to fostering national resilience and adaptation to climate changes;**
4) **Promoting territorial reconnaissance actions to better co-design site-specific, tailored actions for restoring, regenerating and upgrading local Bioeconomy value chains;**
5) **Promoting awareness, skill upgrading, education, attitude, training and entrepreneurships across the Bioeconomy sectors.**

Moreover, the **IAP proposes several ready, concrete and replicable large-scale national projects—** Flagship investments that emerged through consultations with core stakeholders from the National Technology Clusters in the agrifood, biobased industry, blue growth and forestry-wood sectors.
These include:

Flagship 1 – Creation of new local and regional value chains interconnecting rural and/or marginal lands through the implementation of multi-input, multi-product biorefineries which integrate biotechnological and chemical processes and biomass power plants;

Flagship 2 – Biorefineries tailored to the specific sources of renewable carbon in local territories: integrated valorization of agro/urban/industrial biological waste, residues, co-products and by-products.

Flagship 3 – Bioeconomy and biorefineries for the regeneration of industrial sites: full or partial reconversion of traditional fossil oil refineries, chemical plants and other industrial sites;

Flagship 4 – Marine Ecosystem Restoration and Strengthening of the Italian Marine Observation System;

Flagship 5 – Sustainable food design: valorizing Made in Italy through regenerative agriculture, innovative food packaging solutions and healthy diets;

Flagship 6 – Implementation of "Forest Valorization Hubs" with local supply chains for a full development of the wood-based Bioeconomy.

Finally, the updated IAP includes proposals for tailored directives on:

a) protection of food product quality and authenticity;

b) valorization of the biogenic content of biobased products and its role in the decarbonization of the national economy;

c) definition of NACE/ATECO sub-codes for products obtained from biobased feedstock and value chains;

d) promotion of quality standards and measures to support market demand for products obtained from biobased feedstock, along with the development of a legislative framework promoting their eco-design aimed at reducing pollution and contamination of soils and ecosystems;

e) development of by-product management procedures in compliance with regulatory provisions (industrial symbiosis, utilization of urban vegetation management residuals);

f) development of directives and measures related to regulations designed to promote the development of efficient systems for the collection of organic waste, the production and use of quality compost, and the use of food processing by-products as ingredients for food and feed;

g) promotion of a sustainable forest management.

GENERAL CONTEXT

The current political instability, characterized by rising tensions and conflicts involving new areas, combined with the global environmental crisis of climate change, pollution, and biodiversity loss, as well as the social and economic challenges that many countries are facing, has highlighted the worldwide vulnerabilities of the linear production and consumption model, with the dissipation of natural resources, and, most critically, a growing disconnection with territories and communities. It is now necessary to abandon a development approach based on the realization of short-term economic profits and the idea of unlimited growth, which comes at the detriment of the health of the environmental ecosystems, compromising their ability to provide their vital services in the current climate change context. The transition to an economic model that prioritizes environmental and social well-being requires a strong awareness of its generating factors and the actions needed to enable it. **The Bioeconomy is a fundamental pillar of a new development model able to address the growing challenges of climate change, pollution, land and ecosystem degradation, while generating economic and social well-being through the use of local specificities, knowledge and traditions.**

The Bioeconomy, as defined by the European Commission, encompasses the whole range of activities, from the production of food and non-food bioresources—both terrestrial and marine—to their processing and the use of products obtained. It ensures an environmentally, socially, and economically sustainable response to the need for food, biobased materials and energy, while preserving and restoring natural resources and guaranteeing the provision of high-quality environmental services. **Bioeconomy also plays a crucial role in the decarbonization of industrial and energy systems, as well as in the restoration and regeneration of ecosystems and territories, starting with the centrality of health of soils and hydrosphere. Moreover, it can represent an effective accelerator for sustainable innovation and development of rural, hilly and mountainous areas, including marginal, deserted, abandoned, wetland, urban, marine and coastal areas, transforming peripheral areas into strategic centers and driving competitiveness for Italy and Europe**.

Italy owns a long-standing experience of sustainable and circular Bioeconomy. It contributed and continues to contribute to revitalizing national territories by leveraging on relational capital of rural communities, fostering virtuous collaboration and partnerships, and valorizing natural resources while respecting ecosystems and local communities. This experience has been supported by strategic political actions, resulting in the establishment of a national Bioeconomy strategy (BIT) in 2017, in its updating (BIT II) in 2019, and, in 2021, in the set-up of the "Implementation Action Plan 2020-2025 for the Italian Bioeconomy Strategy BIT II" and the formalization of the "National Bioeconomy Coordination Board" (NBCB) at the Presidency of Council of Ministers[1].
Nowadays, it is one of the key pillars of the Italian economy, with 2 million employees and an annual turnover of 437,5 billion euros, which has increased by around 20% over the last 5 years[2].
Despite the actions put in place and the significant investments made in new plants and projects, there is still the necessity to implement further innovation initiatives, more tailored to the specificities of the heterogeneous national territory. Additionally, it is important to improve the regulatory framework

[1] To better unleash the potential of the Italian Bioeconomy, the Prime Minister's Office (Mr. Renzi and Mr. Gentiloni's Government) promoted in 2016 and 2017 the establishment of a national Bioeconomy strategy (BIT) and, more recently (2019, 1st Mr. Conte's Government), its update (BIT II) and the related Implementation Action Plan (Implementation Action Plan 2020-2025 for the Italian Bioeconomy Strategy BIT II) and the formalization of the NBCB at the Presidency of Council of Ministers (2020, 2nd Conte's Government) (https://cnbbsv.palazzochigi.it/en/Bioeconomy/).
[2] https://group.intesasanpaolo.com/content/dam/portalgroup/repository-documenti/research/it/bioeconomia/2024/La%20Bioeconomia%20in%20Europa%20giugno%202024.pdf.

and promote a long-term incentive policy capable of leveraging on our national strengths in terms of innovation and high-quality standards. Environmental benefits need to be fully valorized by creating an agile framework to overcome the current barriers of characterization of certain products, such as turning waste into ready-to-use by-products, in a circular economy approach. Furthermore, the potential of adopting advanced Artificial Intelligence-based technologies, along with the use of high-performance computing and cloud infrastructures, should be better valorized. Notably, initiatives such as the AI Innovation Package[3] and EuroHPC[4], promoted at both European and national levels, can play a key role in enabling these advancements and are readily available at the national level.

Additional measures and incentives are also required to promote sustainable and circular Bioeconomy activities and products, ensuring an assessed reduction in environmental impacts and the restoration of carbon content in the soil. This includes the production and use of quality compost and of other ecosystem services. Additional obstacles include the incomplete application of laws already in force, along with related sanctions, as well as the lack of consistency in the authorization approach regarding End of Waste due to the discretion of the various local legislations when a case-by-case approach is adopted. At the same time, it is important to support industrial research in the adoption of new legislation that will allow the industrial sector to efficiently implement the new rules.

The development of new flagship investments, in synergy with the removal of regulatory bottlenecks, will mobilize the Country's best resources and bring out a generative, competitive and sustainable creativity. This distinctive element will make Italy a unique, exemplary model - at both EU and global levels - of resilient development, integrating economic, social and environmental dimensions, regenerating territories, creating quality jobs and leveraging skills, education and infrastructures.

[3] Commission launches AI innovation package: https://ec.europa.eu/commission/presscorner/detail/en/ip_24_383.
[4] EuroHPC initiative: https://eurohpc-ju.europa.eu/index_en.

THE RELEVANCE OF A SUSTAINABLE AND CIRCULAR BIOECONOMY IN ITALY

Bioeconomy is one of the crucial and enabling pillars of Italian economy. With an annual turnover of approximately 437,5 billion euros and 2 million employees (2023[2]), Italy is the third Bioeconomy in Europe, behind Germany and France. However, the Country has often been second in Europe in terms of presence in the R&I projects funded by Horizon 2020 Societal Challenges 2 and BBI JU, Horizon EU cluster 6 and CBE JU, and ranks first in terms of biodiversity richness and number of quality products in the food and bio-based markets. **The circular Bioeconomy contributes to the reduction of the Country's dependence on fossil resources and finite materials, biodiversity losses and land use changes**. Furthermore, it **contributes to environmental restoration and regeneration, as well as the creation of new economic growth and jobs in the rural, hilly, mountainous, coastal, marine and former industrial areas**, leveraging on regional specificities and traditions, ensuring fair profitability for the primary sector.

The Italian Bioeconomy has proven to be resilient to the multiple crises of recent years; deeply rooted in the territories and capable of enhancing their intrinsic adaptive qualities and community spirit, it has demonstrated to be capable of rethinking production logics and distribution in a timely manner, ensuring both production and socio-economic stability while giving absolute priority to the health and safety of people and communities, fostering new investments in circular and biological sourcing production and behavior, and promoting a spirit of solidarity across the entire supply chain.

The **products of the sustainable and circular Bioeconomy are feeding several core manufacturing sectors of the "Made in Italy"**, contributing to create new competitiveness **through the adoption of an eco-design approach** (sustainable-by-design); a concrete example of this approach is the use of engineered timber products, well-suited for prefabrication, which offer optimized transport capacity and the ability to rapidly assemble (or disassemble) large modules, with low demand for resources and energy-intensive investments. These outcomes are made achievable through the adoption of **key enabling technologies such as synthetic biology and biotechnology, for which AI technologies constitute a fundamental tool for innovation and scalability.**

It would be desirable to involve small businesses, cooperatives and emerging businesses, helping to facilitate the development of a solid local economy, particularly in rural, hilly, mountainous and coastal environments. In this context, **renewable energy communities** could also play a crucial role **in supporting potential economic and social innovation** practices in local society**. Renewable energy communities can increase the economic profitability** of systems based on biomass or other renewable technologies by using local resources in line with circular economy principles. Ultimately, these institutions improve efficiency and enhance local resilience by supporting local energy independence.

To further exploit the whole Bioeconomy potential, **the Italian Government promoted the setup of the National Bioeconomy Strategy in 2017 (BIT I) and, more recently, its update** ("A new Bioeconomy strategy for a sustainable Italy", **BIT II, 2019[5])** and **a related Implementation Action Plan** (Implementation Action Plan 2020-2025 for the Italian Bioeconomy Strategy BIT II, 2021[6]) along with **the formalization of the National Bioeconomy Coordination Board (NBCB) at the Presidency of Council of Ministers** (2021) (https://cnbbsv.palazzochigi.it/en/Bioeconomy/).

The BIT II and the BIT II IAP (2020-2025) are aiming at more efficiently interconnecting the main

[5] https://cnbbsv.palazzochigi.it/media/1774/bit_en_2019_02.pdf.
[6] https://cnbbsv.palazzochigi.it/media/2078/iap_2332021.pdf.

economic sectors that make up the Italian Bioeconomy, namely the production of renewable biological resources and their conversion into valuable raw materials, food, feed, biobased products, pharma and cosmetic compounds, wooden products, and bioenergy, along with the transformation and valorization of bio-waste streams. **The NBCB**, joined by high-level representatives from i) national public private technology clusters active in the different Bioeconomy domains, ii) main relevant Ministries, iii) national Regions and autonomous Provinces, etc., **will ensure the widespread implementation of the BIT II and BIT II IAP priorities across the whole country. This will be achieved by promoting alignment and synergies in terms of national policies and regulations, R&I funding programs, infrastructure development, education and training programs, and communication initiatives. So far, from 2018 to date, the national Bioeconomy turnover has increased by approximately 20%**.

SCOPE OF THE PRESENT UPDATED IMPLEMENTATION ACTION PLAN

Given the general context and the recent investments in biobased product manufacturing in extra-EU Countries, particularly in China and the USA, it is crucial for Italy to fully grasp the Bioeconomy knowhow and potential that have been generated so far. This knowledge can play a significant role in the decarbonization of its economy and environmental regeneration.

A positive sign refers to the recent EU communication, "Building the future with nature: Boosting Biotechnology and Biomanufacturing in the EU", launched on March 2024 by the EU Commission[7], which emphasizes the vital role of Bioeconomy in addressing global challenges. However, both European and national regulatory set-up require more coherence between the various dossiers and a stronger push toward the sustainable and circular Bioeconomy sector, supported by concrete market measures and simplifications.

The NBCB of the Presidency of Council of Ministers[8] drafted the present revised IAP with **the objective to translate the remaining emerging BIT II priorities into well-defined actions and related monitoring measures, thus ensuring an operational roll-out of Italy's Bioeconomy potential across the whole Italian territory over the next three years**. **The plan is consistent with other national strategies related to the production of bioresources, their mobilization and use within ecological limits, as well as the following EU initiatives**: the new Circular Economy Action Plan "For a cleaner and more competitive Europe"[9]; "Fit for 55% package"[10]; the Soil Strategy[11]; the "Water framework Directive"[12]; the "Marine Strategy Framework Directive"[13]; the "Biodiversity for 2030"[14] and "Farm to Fork" Strategies[15]; the "new Restoration Law"[16]; the "New Eu Forest Strategy 2030"[17]; the EU Action Plan for "Protecting and restoring marine ecosystems for sustainable and resilient fisheries"[18]; the communication "On the Energy Transition of the EU Fisheries and Aquaculture sector"[19]; "Strategic Guidelines for a more sustainable and competitive EU aquaculture for the period 2021 to 2030"[20] and the "New strategic vision for sustainable aquaculture production and consumption in the European Union"[21], all part of the EU Green Deal.

The present IAP also promotes the alignment of the Italian Bioeconomy priorities and actions with those foreseen in the frame of the Common Agricultural Policy (CAP) and Horizon Europe, especially

[7] COM(2024) 137 final, 20.3.2024.

[8] Active in the frame of the National Committee Biosafety, Biotechnology and Life Sciences of the same Presidency, involving representatives of five Ministries and of the 20 Regions and Autonomous Provinces, ISPRA, SVIMEZ, and the main relevant National Technology Clusters - public private partnerships -, who developed BIT II.

[9] https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en.

[10] https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55/#what.

[11] COM(2021) 699 final.

[12] https://environment.ec.europa.eu/topics/water/water-framework-directive_en.

[13] https://research-and-innovation.ec.europa.eu/research-area/environment/oceans-and-seas/eu-marine-strategy-framework-directive_en.

[14] https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en.

[15] https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en.

[16] https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-law_en.

[17] https://environment.ec.europa.eu/strategy/forest-strategy_en.

[18] https://oceans-and-fisheries.ec.europa.eu/policy/common-fisheries-policy-cfp/action-plan-protecting-and-restoring-marine-ecosystems-sustainable-and-resilient-fisheries_en.

[19] https://oceans-and-fisheries.ec.europa.eu/publications/communication-commission-energy-transition-eu-fisheries-and-aquaculture-sector_en.

[20] https://www.fao.org/faolex/results/details/en/c/LEX-FAOC206189/.

[21] https://op.europa.eu/en/publication-detail/-/publication/e8bd0eb1-093a-11ec-b5d3-01aa75ed71a1.

in its Cluster 6 “Food, Bioeconomy, Natural Resources, Agriculture and Environment”, and the related Missions and Partnerships.

The overall goal of the present updated IAP is to further boost, in a more territorially focused way, the benefits of the Bioeconomy mentioned above, by ensuring an additional 15% increase in the current turnover and jobs within the Italian Bioeconomy by 2030. This will be achieved through the implementation of priority actions outlined in the following sections, supported by measures designed to create and ensure the necessary framework conditions.

BIT II IAP 2025-2027 is also well aligned with the European Union regulatory efforts, which have focused their intervention on climate change, energy, agriculture, food, feed, forestry, wetland, marine, maritime, aquaculture and fisheries sectors, along with a **strong emphasis on the efficient use and restoration of natural resources, including land and soil resources and sustainable waste management**. Special attention is devoted to the health of soil, which plays a key role in the sustainable and circular Bioeconomy as a fundamental source of essential elements for plant, animal and human life on earth, according to the One Health paradigm.

The NBCB will facilitate the implementation of such actions and yearly monitor the IAP adoption processes. It will also closely **cooperate** with the coordinators of the Bioeconomy strategies active in the **other EU Member States,** mainly **in the frame of the “European Bioeconomy Policy Forum”**[22] and associated initiatives. This cooperation will facilitate the exchange of best implementation actions and practices, enhance inter-country cooperation and joint initiatives, promote the widespread implementation of Bioeconomy strategies across all EU Countries, and help shape a concrete agenda of joint actions and recommendations aimed at strengthening the development of the Bioeconomy throughout Europe.

Some of the BIT II IAP 2025-2027 priority actions can also be exploited in partnership for the promotion of sustainable Bioeconomy in countries of the Mediterranean basin and of Africa. Currently, more than 65% of the population in the south Mediterranean area and Eastern Africa depends on biological resources for food, energy, medicine, and other uses. However, the overall production of biological resources in those areas is decreasing due to the highly adverse effects of the locally marked climate changes. Some coastal wetlands in the southern Mediterranean basin are seriously threatened by the reduction of water and sediments, coastal erosion, subsidence, drought, salinization, and loss of biodiversity, all of which affect their main economic activities (agriculture and tourism), which are based on natural capital. Furthermore, these same countries frequently use biological resources in their raw form and dispose of significant portions of them as biological waste, losing value and generating environmental problems. Such natural resources should be more fully exploited to produce local food and other value-added products, thereby creating jobs, improving health and food security, generating wealth, and connecting smallholder farmers to new biobased value chains. Additionally, the creation of new forms of sustainable bioenergy and the conversion of waste materials into useful products will play an important role in protecting the local environment and combating climate change. Thus, the local implementation of some of the priorities elaborated in the present IAP, often consistent with those quoted in the Regional-East-Africa-Bioeconomy-Strategy[23], could contribute to mitigating and reversing some of the mentioned threats, extending the restoration of the local natural capital and regenerative agriculture.

[22] https://research-and-innovation.ec.europa.eu/research-area/environment/Bioeconomy/european-Bioeconomy-policy-forum_en.

[23] https://www.iacgb.net/lw_resource/datapool/systemfiles/elements/files/2ebdbc71-a097-11ed-9ee4-dead53a91d31/current/document/EAC-Regional-East-Africa-Bioeconomy-Strategy.pdf.

Italy is the largest EU Country located in the centre of the Mediterranean Sea, and it has recently launched the national Mattei Plan aimed at implementing partnerships and joint projects with Algeria, the Democratic Republic of Congo, Egypt, Ethiopia, Ivory Coast, Kenya, Morocco, Mozambique and Tunisia, particularly in the Bioeconomy landscape (e.g. agriculture and food security, water and energy security, as well as health, education and training). The planned initiatives will be co-designed in collaboration with local communities and rolled out in synergy with ongoing European initiatives and other international partners.

The Italian Bioeconomy ecosystem, driven by the NBCB, can flank Mediterranean and African countries in the adoption and local implementation of some of the regenerative and sustainable Bioeconomy practices optimized in Italy. This can be achieved within the framework of the Mattei Plan and via the tailored mobilisation and joint exploitation of opportunities offered by partnerships such as PRIMA[24], SBEP[25] and CBEJU[26], the Horizon EU Missions "A Soil Deal for Europe"[27] and "Restore our ocean and waters by 2030"[28], and in close cooperation with initiatives like WESTMED[29] and EUSAIR[30]. These actions would surely contribute to enhancing social cohesion and political stability in these strategic macro-areas of the planet.

[24] https://prima-med.org/.
[25] https://www.mur.gov.it/it/aree-tematiche/ricerca/sustainable-blue-economy-partnership-sbep.
[26] https://www.cbe.europa.eu/.
[27] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/soil-deal-europe_en.
[28] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/restore-our-ocean-and-waters_en.
[29] https://westmed-initiative.ec.europa.eu/.
[30] https://ec.europa.eu/regional_policy/policy/cooperation/macro-regional-strategies/adriatic-ionian_en.

THE UPDATED BIT II IMPLEMENTATION ACTION PLAN 2025-2027

A significant part of the priorities identified in BIT II has been implemented during the past years, largely due to the guiding actions of the BIT II IAP 2020-2025. To facilitate the implementation of the remaining priorities of BIT II, as well as the new ones outlined in previous chapters, the following new operational actions have been identified in the present updated BIT II IAP. **They are:**

1 - **Launch of territorial pilot actions to support the national Bioeconomy across the agrifood, biobased, forestry, wetland, energy and marine and maritime sectors, in rural, coastal and urban areas;**

2- **Promoting the development and adoption of policies, standards, labels, certificates and emerging market-based actions, including fiscal and financial incentives, to enhance the production of innovative products and energy from all nationally available biological feedstocks, in line with the EU relevant normative**;

3 - **Enhancing the knowledge as well as the monitoring, sustainable management, protection and restoration of national biodiversity, ecosystems and soils, while strengthening their contribution to fostering national resilience and adaptation to climate changes**;

4 - **Promoting territorial reconnaissance actions to better co-design site-specific, tailored actions for restoring, regenerating and upgrading local Bioeconomy value chains;**

5 - **Promoting awareness, skill upgrading, education, attitude, training and entrepreneurships across the Bioeconomy sectors.**

ACTION 1

Launch of territorial pilot actions to support the national Bioeconomy across the agrifood, biobased, forestry, wetland, energy and marine and maritime sectors, in rural, coastal and urban areas.

1.1 Bioeconomy of rural, hilly, coastal and mountainous areas

Rural areas in Italy account for over 90% of the national territorial surface, characterized by a predominantly hilly territory (equal to about 41.5% of the total surface area), followed by mountainous (35.3%) and plain (23.2%). Italy also counts 8,000 km of several poorly valorized coasts and coastal areas, partially impacted by anthropic and industrial activities.

Therefore, tailored actions are required for more efficiently and sustainably valorize such territorial specificities, local knowledge and traditions, by preserving the local races and varieties, as well as genetic diversity.

The position of farmers, especially family farmers and small farm holders in rural, hilly, mountainous and coastal areas, must be enhanced through measures that promote cooperation and ensure effective mechanisms against unfair trading practices.

Furthermore, it is necessary to generate new attractive spaces and opportunities for young people in those same areas.

The digital transition, along with the sustainable and responsible management of primary production and forests, could facilitate the repopulation of rural, hilly and mountainous areas.

"Living labs", where place-based, multidisciplinary, multi-stakeholders and ecological-based innovations and experiences are provided and shared among farmers, forest and wetland owners, advisors, researchers, businesses, policymakers and citizens, can also help to implement such priorities. These living labs promote the aggregation of local Bioeconomy actors and businesses, while fostering the creation of new site-specific value chains. Several living labs have already been set up in the frame of national and EU projects, but they need to be “institutionalized”, i.e. sustained beyond the duration of the financed projects to ensure their long-term viability.

To boost the Bioeconomy in the rural, hilly, mountainous and coastal areas, the following sub-actions are proposed:

- **Promote a more effective assessment of the needs and opportunities in rural, hilly, mountainous and coastal areas**;

- **Strengthen the economic resilience and attractiveness of rural, hilly, mountainous and coastal areas**, also via digital tools for safeguarding, protecting and wisely exploiting their natural and cultural heritage and ecosystems;

- **Develop, institutionalize and leverage “living labs”** as place-based, local infrastructures where multiple disciplines and stakeholders can exchange ideas, co-create, test and replicate territorial tailored agri-food, forestry, wetland, marine-based practices at different scales (e.g. from pilot to landscape) to sustainably exploit the specificities and potential of the local Bioeconomy, making hilly, mountainous and coastal areas more attractive;

- **Promote the transition of agriculture, livestock husbandry, and aquaculture practices in rural, hilly, mountainous and coastal areas** towards land use and management practices that capture and

store CO_2, improve the resilience and adaptation of local ecosystems and communities (including towards extreme weather events), and support and enhance the livelihoods of rural and local communities;

- **Promote Sustainable and responsible forest management, as well as wood and forest-biomass, in line with the cascade approach** to 'cure' rural, hilly, mountainous and coastal forestry by preventing diseased, pest-affected parts, or by thinning out woody material that would have no other market;

- **Develop and implement the** "**Forest Valorization Poles**" as a cooperation network between the different rural, hilly, mountainous and coastal forests to responsibly and efficiently utilize their raw materials such as cork, resins, mushrooms, medicines, nuts, game and berries, assigning priority to woody material based on the greatest added value that can be generated along the wood value chain;

- **Promote the sustainable energy valorization of waste and residues from forest management activities** through the creation of specific territorial platforms for the collection and transformation of residual woody biomass into wood chips, pellets and other solid biofuels, which can be used to produce heat and/or electricity to serve local communities.

In addition, we need to **restore certain national coastal areas** impacted by intense human and industrial pressure. Specifically, we must focus on recovering their biodiversity, ecosystem and local communities and, in turn, their socio-economic and cultural values, generating new jobs and value chains locally, in alignment with the EU Biodiversity Strategy for 2030 and to the EU Nature Restoration Law. Some marine area restoration actions have been recently initiated as part of two national large-scale projects funded with the NextGenerationEU funding (e.g., the projects Marine Ecosystem Restoration – MER – led by ISPRA, mobilizing 400 Million Euros, and the National Biodiversity Future Center – NBFC – led by CNR, with about 10 Million Euros specifically dedicated to marine restoration).

However, **the following sub-actions are recommended:**

- **enhance national marine ecosystem observation, and launch** non-stationary, **in situ marine and marine-coastal monitoring systems**, mapping coastal and deep-sea marine habitats of conservation interest;
- **define good practices for the environmental restoration** of **marine benthic habitats** and habitats of high conservation value and interest (e.g., seagrasses, coralliferous reefs, Cystoseira algae forests, Mediterranean oyster banks), taking into account optimal hydrographic, geomorphological and biocoenotic conditions;
- **design**, implement and test **in situ restoration protocols**, from coastal to deep sea areas, and **measure** and monitor **restoration benefits** in terms of biodiversity enhancement and ecosystem services;
- **foster cross-sectoral collaborations** to engage private actors in the socio-ecological restoration actions;
- **encourage policies, economic incentives and job creation in marine ecological restoration** to create favorable conditions for developing restoration value chains.

1.2 Agri-food sector

The agricultural sector employs approximately 870,000 people and generates 80 billion euros of turnover[2]; it has been recently marked by a drop in production volumes (-1.5%), which particularly affected plant crops (-2.5%), alongside a significant increase in production value (+15.4%). The decrease in production is linked to climate conditions, which are becoming progressively extreme throughout the country, featuring periods of prolonged drought and high temperatures interspersed with intense flooding, excessively mild winters and late frosts. The unprecedented rise in production value, however, can be attributed to high inflationary pressure, which caused a significant increase in production costs (+24%) and, to a lesser extent, in the prices of agricultural products (CRA report 2023[31]).

The Italian food and beverage industry represents the most prominent sector of the Italian Bioeconomy, with an annual turnover of 195 billion euros, 60,000 companies, 490,000 employees and over 50 billion euros in export value in a year[2].

It relies on a large variety of quality, typical products that are prominent components of the Mediterranean diet, globally recognized as a model for healthy, balanced nutrition, that promotes a good state of health and helps preventing onset of significant pathologies associated with diet.

The sustainability and circularity of Italian agri-food value chains could be further increased through the integrated valorization of their by-products and waste, through the production of biobased products and energy.

These by-products often contain phytochemicals, bioactive peptides, prebiotics, dietary fiber, minerals, polyunsaturated fatty acids, carotenoids, or antimicrobial ingredients of high quality, etc. that can be exploited as valuable bioactive ingredients for health-promoting products, which can be used both in the formulation of new food products that combine health and acceptability performances, and to improve the safety and shelf life of conventional food.

The following sub-actions are proposed for the sector:

- **Promote the development of integrated supply chains involving the different actors** (agriculture, processing, biorefineries);

- **Support advanced water-nutrient-soil management** that integrate multidimensional data from sampling, remote sensing and other data sources to enable context-specific decision-making at farm level, thus enhancing the monitoring of water, nutrients and greenhouse gas balances, thereby reducing agriculture production pollution;

- **Boost mixed production systems** (e.g., crop-livestock, intercropping, agroforestry and grasslands) to enhance agrobiodiversity and improve the delivery of added ecosystem services;

- **Promote sustainable, resilient, productive and healthy cropping systems** through early detection, prevention and integrated approaches to tackle plant pests, alongside the use of low-input practices and new technologies, including advanced digital and big data technologies, useful for supporting sustainable farming approaches, as well as the adoption of pathogen and environmental stress-resistant/resilient species, also generated via New breeding and Genetic Techniques (NGT);

- **Promote the use of sustainable Bioeconomy products for agricultural use,** such as biodegradable mulch films, bio-herbicides, bio-lubricants for agricultural machineries and compost derived from

[31] https://www.crea.gov.it/documents/68457/0/ITACONTA+2023_INGLESE_def_WEB.pdf/6e8f93ca-b044-2534-db0c-62dd9229cdbd?t=1715264726140.

organic waste treatment;

- **Promote a more effective management**, e.g. containment and eradication, of veterinary diseases, with a focus on the African Swine Fever (ASF), via a holistic and sustainable approach which should include economic relief for the entire supply chain (not limited to farms directly affected by the disease), along with the development of: a) vaccines for long-term disease control, b) new diagnostic technologies for rapid and accurate disease detection, c) new decontamination techniques to reduce the spread of the virus in the environment and d) predictive models to identify areas at risk of ASF outbreaks, enabling the implementation of targeted preventive measures. In addition, to facilitate international trade, efforts should be made to ensure that the disease-related effects in feral pigs are managed separately from those in reared pigs, following the model already in place for avian influenza. ASF is a complex challenge that requires constant commitment from all actors involved;

- **Improve practices and production across the food industries**, wholesale, retail and food services to enhance their sustainability, promote the use of sustainable biomass, and lower their gas emission and use of fossil fuels;

- **Develop new food processing methodologies** (including circular and biobased feedstock for food packaging, as well as compostable items) based on minimizing technological damage, in order to decrease food loss and food waste and increase productivity;

- **Develop new healthy and sustainable food products** and diets for all citizens, while promoting the use of innovative foods, macro and micronutrients;

- **Improve scientific identification/documentation of Italian regional products** within the Mediterranean diet to further promote the image of this food style's cultural, anthropological, nutritional and health relevance through solid scientific evidence, on a global level;

- **Standardize methods for assessing bioavailability and functionality** (antioxidant, anti-inflammatory, immune-modulatory, neuroprotective, and anticancer properties, etc.) **of ingredients obtained from by-products;**

- **Improve transparency and reinforce consumers trust** via new technologies, traceability, monitoring, control and surveillance systems, as well as the prediction, identification, assessment and management of existing and emerging food safety issues across food systems;

- **Prevent and reduce food loss and waste** via alternative markets and better collaboration between countries inside and outside the EU, while promoting the effective collection and treatment of unavoidable food waste and the use of the organic waste to create value in the Bioeconomy sectors (renewable products and energy, i.e. compost, chemical and biofuels);

- **Develop local public facilities for storing, pre-treating and stabilizing fruit and vegetable waste** (via pasteurization and subsequent drying by freeze-drying or spray-drying), enabling integrated biowaste valorization by SMEs and start-up users, thus encouraging the whole valorization of precious biological resources and the creation of new jobs;

- **Promote and develop innovative logistics platforms** to manage and better share residues, co-products and by-products, facilitating their sustainable and efficient exploitation**;**

- **Develop tailored biorefineries** to fully valorize agri-food by-products and waste, in order to obtain high value healthy ingredients for the formulation of ready-to-eat and other modern new food/feed products, along with products obtained from biobased feedstock (chemicals, materials and fuels, including Bio-H_2) of prominent interest to the pharma, biocosmetic, as well as the chemical, plastic,

textile and energy sectors;

- **Promote forest management practices** that can prevent and mitigate the effects resulting from extreme events caused by the current climate crisis, such as hydrogeological risk, flooding and large-scale fires.

1.3 Forestry sector

Every year, Italy uses only 30% of the wood that grows in its forests (12 million hectares), compared to a European average of 75%. To increase and optimize CO_2 capture by forests, it is necessary to plan the rotational cutting (at least every 30 years) of the coppice forest, which constitutes over 50% of Italy's forestry heritage. Respecting sustainable wood use practices, only 50% of this wood (consisting mostly of waste and by-products of processing) is intended for energy production. Wood represents a natural and sustainable material that should play a significant role in decarbonization and in the construction sector within the framework of the New European Bauhaus initiative. The structural use of wood should be promoted in both public and large-scale buildings, as well as in residential ones. Additionally, wood can be utilized in the retrofitting of existing and historic buildings. To adhere to established rules of public procurement policies, construction wood should originate from certified forests that meet the standards of the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification Schemes (PEFC).
Historically, wood has been considered a source of energy through direct combustion. However, recent technologies can enhance its value as a sustainable source for hydrogen production through digestion and/or gasification, thus maintaining wood's traditional role as an energy carrier while facilitating a sustainable energy transition.

Therefore, **the forestry and wetland sectors** play a strategic role in the national economy, ensuring a range of benefits to people and ecosystem services, including climate change mitigation and adaptation, hydrological services, erosion reduction, and enhanced wildlife habitats, as well as landscape recreation and other relational values. However, in line with the national Forestry strategy (2022), the National Forestry Accounting Plan (2018), the National Energy and Climate Plan ((EU)2018/1999) and the European Guidelines for the forestry sector (2023), and consistent with the aforementioned cascade use principle, the sector needs **to be reinforced by addressing the following priorities**:

- **the responsible and sustainable use of forests**, starting with abandoned ones, by facilitating the cooperation among local supply chains across different economical fields (manufacturing, ecosystem services, energy and biorefinery etc.);

- **the accessibility to forests and logistical infrastructures;** this can help prevent the diffusion of phytosanitary and facilitate firefighting efforts in the event of a forest fire;

- **the cascade approach**, which provides the right wood being used in the right supply chains, facilitating the multiple uses of wood, starting with construction and wood-based panels and extending to the production of biobased chemicals, materials and energy;

- **the use of by-products and woody residues coming from trees outside forests** (e.g., urban green pruning, crashing from meteorological events, beached timber) to produce biobased chemicals, materials and energy. These actions allow public administrations to actively implement circular economy, reusing resources, reducing waste production and accumulation, recovering energy and converting a disposal cost into a revenue item;

- **the development of value-added applications** for wood polymers, carbon fibers or ultra-lightweight composites obtained from wood, in the construction, interior design, packaging and chemical sectors.

1.4 Biobased industry

The production of products and energy using biobased feedstock derived from non-food biomass, by-products and biowaste is another prominent sector of the national Bioeconomy, with an overall turnover of approximately 170 billion euros and 620,000 employees[2]. This sector is represented by a quite relevant national pulp and paper and wood transforming industry (about 50 billion euros and 170,000 employees), as well as by biorefineries (about 125 billion euros and 450,000 employees).
In fact, the efficient and clean transformation of renewable raw materials into functional chemicals and fuels is supported by fundamental innovations in synthetic chemistry and driven by biorefinery applications. The existing multi-product biorefineries are fed with renewable feedstocks from sustainable biomass (e.g. agroforestry biomass, intermediate crops, crops grown on marginal and degraded lands and areas, biowaste and by-products of the agri-food, livestock, forestry, marine and maritime sectors or/and municipal organic waste, as well as biological sludges coming from the wastewater treatment). The choice of feedstocks depends on the technologies implemented by the biorefinery and the local availability of biomass. The ones fed with agroforestry biomass sourced from marginal, abandoned, and degraded lands, wetlands and/or coastal areas, are generating strategic opportunities for the mentioned landscapes. These biorefineries can constitute a source of income diversification and an additional element of profitability for all the local stakeholders along the value chain (including those in the primary sector), thus contributing to the regeneration of the territories and contrasting their degradation, abandonment and desertification. The biowaste-fed biorefineries are combining the production of valuable and innovative biobased chemicals, materials and fuels, while preventing waste disposal and its environmental impacts. Moreover, some of the Italian biorefineries have been installed in former industrial sites (e.g., oil refineries and chemical plants), often in synergy with the local biomass production sector. In this cases, the economic benefits of the innovation are combined with the re-conversion, re-industrialization and the environmental and economic regeneration of the sites and surrounding territories, along with the establishment of new agro-industrial value chains, and the valorization and enhancement of the existing infrastructures, services, skills and professions.
Among the products obtained from biobased feedstock, biofuels play a key role in decarbonizing the transportation sector. In particular, the uptake of more sustainable biofuels, which offer high emission savings and avoid the food and feed conflict, should be prioritized. Their role will also be critical in hard to abate sectors like aviation and maritime, where few green alternatives exist. Biofuel could also support the transition of the isolated energy systems (e.g. small islands).
Another example of application is the design of biodegradable and compostable plastics produced sustainably from renewable resources, which can improve organic waste management and avoid the dispersion of microplastics in the environment.

The following sub-actions are proposed for this sector:

- **Produce high value compounds** through bioprospecting of terrestrial ecosystems;

- **Exploit Molecular biology, Synthetic biology and microbiome knowhow** for the production of novel, advanced, bio-inspired materials, as well as optimized enzymes for the industrial-scale production of fine chemicals and pharmaceutical intermediates in highly selective biocatalytic processes;

- **Promote the eco-design of bioproducts in line with the National Strategy for Circular Economy;**

- **Support the integrated valorization of agro/urban/industrial biomass, co-products and residues (waste and by-products) toward integrated multi-input and multi-product biorefineries** benefiting the territories for the production of chemicals, materials, products and sustainable biofuels[32] (e.g. biomethane as a renewable gas for industrial uses, Sustainable Aviation Fuels (SAF), Maritime biofuels and sustainable biofuels for road transportation), fully aligned with policies such as the RED II Implementing Regulation and Delegated Acts, in order to find address specific environmental, economic and social concerns (e.g. management of organic residues, degradation of agricultural soils and water pollution, decarbonization objectives and emissions reduction);

- **Create circular Bioeconomy value chains based on the valorization of sustainable** crops (e.g. agroforestry and intermediate crops, crops grown on marginal and degraded lands and areas, biowaste and by-products of the agri-food, forestry, marine and maritime sectors) for producing different types of chemicals, products and energy, including sustainable biofuels, biogas and bio H_2, contributing to enhancement and revitalization of the economy, as well as the environmental and social relevance of the areas. Moreover, biofuels and biogas from biomass will help meet the targets of both the RED III directive and the REFuel Aviation Regulations on aviation and maritime sectors. The use of biomass to produce bioproducts, such as bioplastics, is a fundamental part of the solution for addressing some of the environmental challenges related to fossil feedstock sourcing. Sustainability criteria for biobased feedstock for plastics should be defined using the criteria in Article 29 (2-7) of RED III, concerning land use and biodiversity, as a starting point, and ensured by third party independent auditing. Given the complexity of sourcing and production pathways in the plastic value chain, a more systemic approach will be necessary to strike a careful balance among the need to reduce fossil resource dependency, the interplay with other sectors relying on biomass and the necessity to ensure the sustainable development for biobased feedstock for plastics;

- **Support the total or partial reconversion of former oil refineries or chemical industrial areas and sites** into biorefineries for chemicals, products and energy which could support and implement environmental, economic and social sustainability, while ensuring an alignment with the need to achieve European Green Deal objectives. To spur opportunities in such directions, **a public database of existing former oil refineries or chemical industrial areas in the Italian territory should be created in order to properly identify already existing biobased sites**;

- **Promote the implementation of industrial symbiosis schemes** aimed at fostering the interconnection between sectors and the valorization of different biomass streams, following the cascading approach. The cascading approach and circular economy principles also pave the way for practical implementation, helping companies and public authorities to define some case studies for end-of-waste procedures;

- **Promote studies on new scenarios related to Intellectual Property (IP) rights on plants, which** will be disclosed after the possible approval from the European regulation on the use of **New Genomic Techniques (**NGT) in agriculture;

- **Reduction of fossil resources consumption and emissions in the small and medium-sized business sector** through the replacement of existing systems with highly energy-efficient technologies powered by a mix of renewable sources, or through connection to virgin woody biomass district heating

[32] Biofuels as defined in Article 2, second paragraph, point (33), of Directive (EU) 2018/2001 and which comply with the sustainability and lifecycle emissions savings criteria laid down in Article 29 and certified in compliance with Article 30 of the same Directive.

networks (e.g. restoration of the 22T framework for the recognition of white certificates);

- **Producing and utilizing chemicals in ways that maximize their benefits for society, including achieving the green and digital transitions, while avoiding harm to the planet and to current and future generations;**

- **Promoting the sustainability of manufacturing processes** through green and sustainable chemistry to improve resource efficiency, prevent pollution and minimize waste in industrial processes;

- **Regarding biobased plastics,** their definition does not allow to distinguish between biobased (C14 measured) and bio-attributed plastics, as it relates solely to biomass sources. To provide clarity when defining plastics derived from biomass by referring only to the origin of the feedstock/raw materials, bio-designed plastics may be distinguished into two distinct groups:

  • **Biobased plastics** – plastics derived from biomass according to CEN/TC 411, which verifiably contain constituents of biological origin. Therefore, the biobased content of this plastics can be verified and confirmed in accordance with standard EN 16640 (via radiocarbon methods);

  • **Bio-attributed plastics** - plastics for which mass balance methodology is applied to account for the use of biobased feedstock in their production. This approach, In accordance with standard ISO 22095, is a chain-of-custody model in which sustainable feedstocks (including biobased feedstock) are mixed, according to defined criteria, with materials or products of other characteristics, such as virgin fossil-based feedstock. The mass balance methodology ensures that the use of biobased feedstock in the production of plastics is accurately attributed.

1.5 Blue Bioeconomy

Italy has the largest continental shelf in the Mediterranean basin and ranks second in terms of coastal development. However, its seas remain largely underexplored, particularly for what concerns the deep sea. These waters are expected to represent the most important bioeconomic opportunity for the Country in the near future, especially with the upcoming establishment of the Exclusive Economic Zone (EEZ), which will grant full rights over this area. Italy is also the second-largest producer of marine fisheries products in the Mediterranean and the first in terms of economic value (about 140,000 tons and 750 million euros in 2021, respectively). The national fishing sector showed a decrease in production over the past few decades, largely due to the overexploitation of resources and the consequent reduction in fishing capacity driven by sectoral policies. However, performance and value have gradually improved in the past two years[33]. The main threats include chemical pollution, habitat destruction, the effects of climate change (including tropicalization and acidification, bio-invasions by alien species, modification and loss of biodiversity, changes in marine currents, etc.), the presence of sunken weapons, marine litter, including microplastics, and emissions associated with growing maritime traffic.
In this situation, the EU Biodiversity Strategy for 2030 and the new EU Restoration Law propose a series of short and medium-term objectives in which Italy, thanks to the innovative experiences acquired in recent years, can play a leading role. This is especially true in the development of the methodological standards for establishing new marine protected areas, as well as those defined for conducting both

[33] https://temi.camera.it/leg19/post/dati-sul-settore-pesca-in-italia.html.

active and passive restoration initiatives. These efforts rely on the application of specific and innovative methodologies that encourage collaboration between research organizations and private companies.
The implementation of both international (EU, GFCM) and national policies in the Mediterranean Sea is now generating a significant improvement in fisheries sustainability. While being still far from optimal exploitation, the progression towards sustainable fishing practices and stocks recovery is expected to benefit fisheries production over the medium term. The significant contraction of the fishing fleet is now reflected in a substantial (though not yet complete) reduction in the fishing mortality rate. However, the recovery of stocks' status has not yet been fully reached, and it appears necessary to adopt an ecosystem-based approach and take effective action against the phenomenon of Illegal, Unreported and Unregulated fishing (IUU). Additionally, technological innovation represents an opportunity to decarbonize the fishery sector and enhance its sustainability. Considering these aspects, it is important to emphasize that Italy has adopted the EU Directive 2014/89/EU (adopted by Italy, Leg. Decree n. 201, 17 October 2016), which establishes a framework for Maritime Spatial Planning (MSP) promoted by the EU, the Action on Fisheries (COMN(2023)102 final) and approved the "Sea Plan for the Three-Year Period 2023-2025" through the Decree of 31 July 2023[34].

Italian aquaculture currently provides 150,000 tons of aquatic products farmed from 800 aquaculture sites located in land-based, transitional and coastal waters. Most of this production consists of shellfish (66% production, 55% of value), also recognized as a bioremediation tool (by removing nutrients with a general improvement of the water quality) and able to provide ecosystem services that lead to positive effects in transitional and marine habitats. EU's blue economy strategy identifies aquaculture as the fastest-growing food production sector globally over recent decades. Additionally, the reform of the Common Fisheries Policy, along with the Blue Growth Strategy, the Green Deal, the Farm-to-Fork Strategy and the EU Mission Restore our Ocean and Waters, all promote the aquaculture sector. In this context, the Italian National Aquaculture Development Plan (PNSA) 2021-2030 was developed based on the main recommendations of the new "Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021-2030"[35].

The following sub-actions are proposed to boost the sector:

- **Promote the valorization of ongoing passive and active restoration projects in Italy through the PNRR-MER, envisaging new ones, in order to actively pursue the objective of the EU Nature Restoration Law** of restoring 20% of marine habitats by 2030, fostering the economic development of private entities engaged in this sector and promoting the national development of new, increasingly effective restoration methodologies;
- **Promote the development of sustainable fisheries and aquaculture, ensuring their full inclusion in the MSP**. Fisheries and aquaculture are both affected by maritime use, e.g. human activities such as mining platforms, offshore wind farms, mineral and sand extraction, marine navigation, ports, etc. Special care must be given to the relationship between fishing and planned offshore wind farms (OWFs) to minimize their impact on fisheries (2019/2158 INI) in line with the National Integrated Energy and Climate Plan (PNIEC) and the European Parliament resolution of 7 July 2021. It is therefore essential to involve fishermen in the decision-making progress regarding the siting of OWF plants, and to develop mitigation and compensation strategies to reduce impacts on fishing communities, as well as on fisheries and aquaculture activities in the vicinity of offshore plants;
- **Digitalize fishing activities to enhance the safety and well-being of fishermen and overall value**

[34] https://www.gazzettaufficiale.it/eli/gu/2023/10/23/248/sg/pdf.
[35] https://oceans-and-fisheries.ec.europa.eu/ocean/blue-economy/aquaculture/aquaculture-guidelines_en.

chain efficiency;

- **Reduce CO_2 emissions from fishing vessels by greening ships and fishing ports**, supporting their transition from thermal to electric boat engines, as well as developing electric charging infrastructure at ports and boat parking areas, thus reducing CO_2 emissions and improving product conservation, air quality and the well-being of fishermen;
- **Promote neglected, underutilized and underexploited fish species** that are currently in demand in the market, but that require tailored promotional policies regarding fish quality, as well as measures to prevent alteration and counterfeiting, in accord with the EU's FOOD 2030 R&I goals;
- **Diversify fishery products, promote product traceability and labeling,** and support circular economy models;
- **Reduce fisheries and commercial discards and promote the use of fishing value chain waste,** adopting more selective gear, sustainable packaging to improve product shelf life, and developing integrated valorization strategies to convert discard catch into innovative food products, chemicals and pharmacological substances, materials and energy obtained from biobased feedstock;
- **Contrast Illegal, Unreported and Unregulated fishery (IUU) through** monitoring fishing activities and improving product traceability in the markets via new technologies and **big data exploitation**;
- **Improve the role of fisheries in cleaning up marine litter by** ensuring the free and legal storage and disposal of the marine litter - including plastic waste - collected and landed by the fishermen;
- **Create a national vulnerability assessment framework for aquaculture and fisheries, and develop and adopt tailored mitigation and adaptation strategies. This includes** improving disaster preparedness, resilience to climate change, and adaptation to bio invasions, such as the exploitation of alien species, as well as the implementation of an early warning system for the most harmful alien species and other marine risks;
- **Allocate marine zones for aquaculture (AZA) at regional and municipalities level,** transitioning to predictable and evidence-based licensing systems, in order to increase the number of coastal and offshore marine sites for aquaculture, including the reuse of decommissioned offshore platforms existing in Italy and future Offshore Wind Farms;
- **Develop and/or improve aquaculture plant equipment/technologies,** increasing their environmental sustainability and the well-being of the farmed species. This includes promoting hygienic-sanitary management protocols for farms, aimed at reducing reliance on veterinary drugs while fostering the development of immunomodulators and growth promoters of natural origin, rapid diagnostic methods, and next-generation vaccines for the main pathologies of farmed animals;
- **Promote and develop innovative and sustainable aquaculture nutrition** by identifying natural and functional products which can be included in new aquaculture feed;
- **Increase the use of the microbiome in the aquaculture sector to improve fish productivity,** safety and health, while reducing the environmental impacts deriving from farming;
- **Diversify aquaculture production,** with particular attention to the farming of mollusks and to the FFDR (**Forage Fish Dependency Ratio**) values;
- **Promote measures that encourage the implementation of experimentation in Sustainable integrated multi-trophic aquaculture (IMTA)** to reduce the environmental impact of fish farming.

The impact of this practice on productivity, nutritional quality, health of farmed fish, and market outcomes should be verified. Furthermore, incentives and rewards such as tax relief for producers (IMTA system installed/to be installed), should also be established. The zones designated for IMTA should also be defined with advanced technologies, including satellite and underwater sensors integrated for effective monitoring;

- **Promote incentives for the cultivation of aquatic extractive species, such as seaweed, invertebrates, shellfish and low FFDR (Forage Fish Dependency Ratio)** which can be used not only for the sustainable production of food, pharmaceuticals, new building block chemicals and biofuels, but also for the sustainable bioremediation and restoration of impacted marine ecosystems;
- **Promote the use of biodegradable materials for fishing and aquaculture purposes** (i.e. fishing nets) in all activities that carry a high risk of dispersion or microplastics release;
- **Improve sustainability assessment and design performance-based food sustainability standards and labels,** as well as reliable, cost-effective certification systems to benchmark aquatic food sustainability in both International and European sustainability certification schemes;
- **Promote the recycling of Mollusk Shells** from aquaculture and shellfish processing factories into eco-friendly construction materials for ports and buildings, and **increase the integrated use of by-products from aquaculture and fishery** (both processed products and sludge) in the production of biobased products and renewable energy (wind, solar, waves, bio-H_2) at sea and rural production sites;
- **Boost the potential of blue biotechnology** in the remediation of marine contaminated sites, and the tailored integrated valorization of marine based biomass (including by-products and waste from sea product transformation) for the production of new pharmaceuticals, food/feed nutraceuticals, functional foods, cosmetics, and biomaterials (i.e., packaging and biomedical market);
- **Create Ecologically Equipped Marine Areas (AMEA)** (article 26 of Legislative Decree 112/1998) to promote symbiosis between aquaculture, fishing, sustainable tourism, and other marine activities in shared infrastructures that support research, logistics and waste management, and the collection and recycling of marine plastics waste;
- **Develop, through a precautionary approach**, the economic activities that may arise from the implementation of the interest in the underwater dimension understood both in the context of recreational activities and the use, recovery and protection of the underwater biological and landscape heritage.

1.6 Urban Bioeconomy

With a population exceeding 60 million, Italy ranks among the most populous countries in the world and is home to about 7,900 cities, with the majority of its population residing in urbanized areas. Municipal biowaste, normally perceived as a challenge due to its potential impacts on the environment and public health, can be disposed and converted into a valuable soil improver through composting. Moreover, it can be (bio)converted into key industrial resources (e.g. biobased chemicals, materials, plastic precursors, biofuels and biogas). In 2022, Italy collected 7,25 million tons of municipal organic waste, producing approximately 2 million tons of compost, which brought about 600,000 tons of organic carbon to the soil while saving 3.8 million tons of carbon dioxide equivalent (compared to their landfill disposal). Additionally, it generated an estimated turnover of 1,9 billion euros and created

about 10,000 new jobs[36]. Similar opportunities are associated with the management and disposal of municipal wastewaters. With the new EU waste regulations, the availability of such matrices is growing, which is expected to lead to a higher volume of bio-waste collected and made available in cities, although the current approach to their exploitation is not fully realizing their potential.

The following sub-actions are proposed in this sector:

- **Exploit the full potential of urban biowaste, wastewater sludge,** urban trees, pruning and wastewater via a multi-product integrated biorefinery approach. This includes the use of biobased feedstock for the production of chemicals, materials and energy, alongside clean water, fertilizers, nutrients and critical materials such as nitrogen, phosphorus and potassium;

- **Promote efficient schemes** for the collection and treatment of urban biowaste and wastewater treatment sludges, and their conversion into high-quality compost, supporting the use of compostable bioplastics for waste collection;

- **Promote the citizen awareness and the voluntary initiatives** to improve the collection of domestic used cooking oils, helping to prevent negative environmental impacts from their dispersion and maximize their recycling in biofuel production;

- **Promote the use of compostable bioplastics** for food contact products in contexts where their use improves the collection and treatment of biowaste (i.e. food service at public events, canteens, etc.), in line with the opportunities provided by article 9 of the Packaging and Packaging Waste Regulation;

- **Develop systemic circular economy solutions in cities and regions in line with the National Strategy** for Circular Economy.

A core contribution to the Bioeconomy is also ensured by urban and peri-urban forests and wetlands, playing an important role in improving the quality of life for local populations. In this direction, it is recommended, in line with the national strategies for urban green, forestry and wetlands, and in line with European guidelines and the Forest Strategy for 2030, to promote the management, reforestation and restoration of wetlands in urban and peri-urban areas.

Additionally, we need to rethink our cities and their ecosystems; their shared spaces, buildings, and infrastructures should be redesigned. Without an inextricable and enduring alliance between urban life and nature, the concepts of energy efficiency, carbon neutrality, public health, economic vitality, and environmental sustainability are meaningless. Integrating natural systems, such as forests, grass-ands, wetlands, and marine biomes into cityscapes is essential for both human health and well-being. As proposed by the New European Bauhaus, we integrate three key dimensions: sustainability (including circularity), quality of experience (including aesthetics) and inclusion (along with affordability) to create beautiful, sustainable, and inclusive places, products, and ways of life that effectively address our climate, health, and social challenges.

The following sub-actions are proposed in this sector:

- **Promote the role of green infrastructures and Biocities in improving human health and wellbeing,** as the supporting (e.g., nutrient cycling), provisioning (e.g., food), regulating (e.g., climate regulation), and cultural (e.g., recreation) services provided from diverse Nature Based Solutions are basic elements fundamental to human health and wellbeing. These benefits come from the

[36] https://www.isprambiente.gov.it/files2023/pubblicazioni/rapporti/rapportorifiutiurbani_ed-2023_n-393_versioneintegrale.pdf.

health system, urban ecology, design and planning. In this context, Biocities can help mitigate the adverse physical and mental health effects of urban living, such as heat exposure, air pollution, noise, or sedentary and stressful lifestyle, and this can be achieved, at least in part, by transforming public spaces into green infrastructures, adapting buildings with green components (e.g. green walls or roofs), and increasing the quality of greenness and biodiversity throughout the city. To support this transition, it's important to accurately quantify the contribution of new green planning strategies and develop indicators that help both private and public investors to assess the deriving environmental, social, and economic benefits for society;

- **Diffuse and promote ecologically functional, attractive landscapes through the use of agroforestry systems, particularly in peri-urban areas;**
- **Foster closer connections between the BioCity and its Region**. Strengthening the links of the BioCity with its surroundings, along with multi-level governance, will make cities more socially, economically and ecologically sustainable, as it has been demonstrated in the frame of the initiative "100 Climate-Neutral and Smart Cities by 2030"[37];
- **Promote wide-ranging interventions to revitalize abandoned buildings in both urban and extra-urban areas, proposing and supporting new functions;**
- **Promote *smart grids* to ensure stable energy fluxes, integrating variable and decentralized renewable energy sources.**

[37] https://eurocities.eu/latest/the-100-climate-neutral-and-smart-cities-by-2030/.

ACTION 2

Policies for Biobased Products and Services

Promoting the development and adoption of policies, standards, labels, certificates and emerging market-based actions, including fiscal and financial incentives, to enhance the production of innovative products and energy from all nationally available biological feedstocks, in line with relevant EU normative.

The recommended actions are:

- **Deploy the CAP National Strategic Plan** to boost sustainable biomass production and use, and foster the development of innovative Bioeconomy sectors embedded in locally rooted supply chains through specific measures devoted to:

a) improving the position of farmers and forest owners in the Bioeconomy supply chain, including the promotion of innovative short biobased supply chains and the assessment of farm sustainability and forest management;

b) promoting the use of sustainable chemical substances in the primary production, increasing organic fertilization, reducing the use of harmful chemical substances, and boosting sustainable organic farming and Organic-districts/Bio-districts (including the adoption of new breeding techniques and sustainable production tools), in line with the European Green Deal and Farm to Fork objectives and soil restoration. This also includes the development of new bioherbicide formulations;

c) increasing the sustainability of the livestock sector through feeding strategies that allow the reduction of nitrogen excretion, as well as the management of livestock effluents with the adoption of transformation techniques that produce high-value fertilizers;

d) rationalizing the use of antimicrobials in both terrestrial and aquatic livestock farming;

e) promoting responsible and sustainable forest management, focusing on developing local supply chains and related ecosystem services, including CO_2 storage;

f) protecting and maintaining traditional crop varieties and animal breeds, which are linked to traditional farming systems, while combating invasive species threatening our biodiversity;

g) promoting the production and use of biobased fertilizing products and amendments in agriculture to increase soil organic matter, including the use of certified soil biodegradable mulching films;

h) supporting the full implementation of the National Forest Strategy, including operational and instrumental actions to achieve its specific objectives;

i) fostering climate change adaptation and resilience through sustainable management of agricultural, forestry, wetland and marine areas, promoting agroecological approaches in agroforestry, reducing soil degradation, erosion and hydrogeological risks, contributing to EU soil monitoring and resilience laws, the forest Strategy for 2030, and achieving a more sustainable water management and food safety, along with developing pilot restoration initiatives;

j) promoting the use of biodegradable and compostable products in agriculture, such as mulching films, clips, twines and bioherbicides;

- **Adopt front-of-package labels**, or encourage the adoption of QR codes for consumer information on food packaging, avoiding confusing and misleading overlaps between nutritional, environmental and processing information;

- **Promote a system of incentives** to encourage the conversion of traditional firms to biobased,

including the implementation of monitoring systems to assess effectiveness and results, and incentivize the creation of biobased start-ups;

- **Promote the adoption of standards**, labels, market-based actions and incentives to support the transition towards sustainable seafood production and value chain in line with the objectives of the Farm to Fork strategy, the EU Nature Restoration Law, the Common Fisheries Policy, and the Blue Growth initiatives, enhancing the climate and environmental performance of the marine primary sector;

- **Promote the valorization of passive and active restoration experiences currently underway in Italy with the PNRR-MER program, while envisaging new initiatives to actively pursue the objectives of the EU Nature Restoration Law;**

- **Preserve and enhance of** marine biota **ecosystem services through the establishment of new marine protected areas to safeguard biodiversity hotspots,** avoiding/reducing bycatch and, where necessary, sustainably utilizing non-consumable marine biomass;

- **Contribute to the Common fisheries Policy (CFP) by increasing** the availability of scientific advice for fisheries management;

- **Implement specific policies to valorize domestic wood raw materials** by diversifying the types of wood based on national supply availability, along with encouraging the creation of new supply chains in which residual wood biomass from processing, following a cascade approach, acquires additional socio-economic value, particularly in inland national areas;

- **Unfold Italy's huge potential to balance Carbon fluxes** in resilient, productive and sustainably managed forests and wetlands, as outlined in the LULUCF regulation, through the use of renewable raw materials, by increasing the development of innovative forest products such as biobased chemicals and construction & building materials;

- **Develop and strengthen standards and labels for low-impact products obtained from biobased feedstock** to improve public perception and market acceptance. These should be harmonized with UE Life Cycle Inventories and other tools, including products obtained from biobased feedstock that contribute to lower GHG emissions assessed via LCA procedures;

- **Issue a decree which fosters systematic use of bio-based products providing benefits in terms of sustainability according to recognized standards** by official departments and agencies and in public-sector organizations, hospitals and schools through Green Public Procurements;

- **Encourage investors provision of finances and new sustainable finance instruments specifically created for Bioeconomy sectors** (e.g. banks, "business angels", insurers, pension funds, investment funds, crowdfunding schemes), by increasing the awareness of the Bioeconomy's role in economic development, climate change mitigation and environmental preservation;

- **Promote a capillary digital innovation** and transformation across sectors by designing new business models that can be reproduced and adapted to different social and geographical contexts, leveraging on local actors and territorial resources. An example can be represented by the development of collective and more efficient irrigation systems, able to maximize impacts and minimize irrigation losses;

- **Promote measures**, including fiscal policies and public procurement, **to support biorefineries** that could significantly contribute to strategic sectors of the Green Deal, such as packaging, agricultural innovation, building & construction, transport and energy;

- **Promote the use of products capable of biodegrading in different environments.** For applications where the use of biodegradable and compostable bioplastics is already required by law, provide indication for an increase of the fraction of mandatory renewable matter content. Additionally, introduce a clear definition of "reusable" in the context of implementing legislations on single use products;

- **Strengthen environmentally friendly** and/or biodiversity friendly subsidies for low impact products obtained from biobased feedstock, thus creating a level playing field for biobased industries;

- **Reinforce, as part of the future revision process of the National Integrated Energy-Climate Plan (PNIEC),** the role of woody biomass in the country's energy strategy, particularly for the production of thermal energy, combined heat and power, and sustainable fuels for industry and transport;

- **Promote Bioeconomy priorities and actions in the frame of national and regional ERDF Operational Programs,** supporting research and innovation initiatives while identifying pilot centers related to the specific objectives **of Policy Objective 1 (*A smarter Europe*) and** of initiatives aimed at promoting clean and fair energy transitions, green and blue investments, the circular economy, climate adaptation and risk prevention and management, as envisaged by the specific objectives of **Policy Objective 2 (*A greener, low-carbon Europe***);

- **Promote stronger synergies between the EU Commission's R&I priorities and funding** (Horizon EU Cluster 6 and Bioeconomy relevant Partnerships and Missions) **and those identified and made available at the national and regional level,** along with the allocation of local investments to implement the outcomes of prominent European R&I projects in national and regional territories;

- **Direct special funds to young researchers** to support the development of start-ups whose core business is the development of products and/or processes related to the Bioeconomy sphere.

SUB ACTION 2.1

Energy for Sustainable Bioeconomy Processes

Re-use and Re-store for energy production. Energy storage and distribution for sustainable Bioeconomy processes. Re-vitalize territories via integrated and diverse energy production strategies.

- **Re-examine fossil fuel subsidies and strengthen environmentally friendly** subsidies for the production and use of biofuel (both liquid and gaseous), as well as low-impact products obtained from biobased feedstocks, thus creating a level playing field for biobased industries;

- **Implement specific measures to promote the use of biomass,** biomass residues and management forestry products through a cascade approach for wood, allowing energy transition and competitive energy self-production in circular-economy-based companies, focusing on high efficiency energy production processes;

- **Promote know-how, production and use of green H_2 from biomass** (mainly from woody biomass or waste, while also considering the potential of the primary sector), also in connection with the experience of hydrogen valleys and new and upgraded bio-methane plants, through advanced power-to-gas or power-to-liquid CO_2 conversion processes from biomass fermentation, in order to increase global efficiency of such processes and reduce greenhouse gas emissions;

- **Promote the production and use of biogas, biomethane and liquefied gases, biochar and compost from organic waste** through biodigesters and fermentation plants (biogas refinery). Furthermore, deepen the regulatory status of sludge and other related by-products from sewage and biomass treatment plants in general, which should ideally be considered on a par with those from agribusiness plants, and able to be directly used on agricultural land and recognized as "circular materials";

- **Promote distributed production of biogas, biomethane, digestate and organic fertilizer** from livestock manure, crop residues and non-food crops (biogas refinery), thereby reducing the carbon footprint of the agri-food chain;

- **Promote the use of sustainable biofuels and biomethane** for the decarbonization of Italy's **public and private transportation systems**, offering a potential pathway to promote Soil Carbon Sequestration and therefore sequestering CO_2 from the atmosphere, while aiming at healthier soils;

- **Promote the inclusion and incentivize the use of geothermal** for energy production and other industrial applications. Geothermal energy has great potential for decarbonization and reduction of climate-changing emissions at European, national and local levels. It plays a key role in the decarbonization of civil and industrial sectors. Thanks to its programmability, it provides flexibility and stability to the energy system, ensuring load balancing based on energy demand. It can be used for power production, building heating and cooling, and domestic hot water (DHW) production, increasing energy efficiency by four energy classes and allowing the valorization of existing building stock, including historical ones. Direct uses of underground heat holds high potential in Italy across various sectors, such as thermal (thermal tourism), agricultural applications (greenhouses heating, pasteurization of dairy products and drying and fermentation of food products), aquaculture and other industrial uses. Finally, in the context of the "*Leaving No One Behind"* principle, it guarantees access to energy in internal areas. Geothermal energy can be utilized for:

  a) power production, building heating and cooling and domestic hot water (DHW) production, increasing energy efficiency by four energy classes and allowing the valorization of existing building

stock (including historical ones);

b) direct uses of underground heat, which holds high potential in Italy across various sectors, such as thermal (thermal tourism), agricultural applications (greenhouses heating, pasteurization of dairy products and drying and fermentation of food products), aquaculture and other industrial uses;

- **Support and foster the research and demonstration of BECCS plants (Bioenergy with carbon capture and storage)** as a technique that combines the production of fuels or energy from biomass with the capture and secure, permanent storage of CO_2. BECSS represents an effective solution to accomplish carbon dioxide removal from the atmosphere while also providing energy. It will contribute to the decarbonization of hard-to-abate industries, heavy transport and aviation, as bioenergy can provide high-temperature heat and fuels needed for these sectors.

SUB Action 2.2

Reuse and Recycling: end of waste strategies

Promoting the development/adoption of policies, standards, labels and emerging market-based actions and incentives to enhance the end of waste strategy, all on the basis of reliable, science-driven data on environmental and climate performance, as well as socio-economic and environmental impacts, coherently with the European and national Green Deal and the related European strategies and instruments launched by the European Commission and Agenda 2030.

- **Support waste prevention across all Bioeconomy sectors, as well as the sustainable management of generated biowaste,** through the waste hierarchy, encouraging prevention, organizing effective systems for the use of by-products, incentivizing separate collection, subsidizing recycling and reuse, encouraging the development of cooperatives and local entities promoting integrated collection and valorization and discouraging landfill disposal; support the prevention and reduction of food and feed waste throughout the entire supply chain by offering incentives for consumers and introducing differentiated charges at retail, production and supply chain levels. The valorization and recovery of waste and by-products generated at every stage of the value chain - including food surpluses - should be encouraged, and access to these residues and their distribution as feedback to bio-economy sectors should be facilitated;

- **Increase the use of sustainable food packaging that ensures longer product shelf life** while addressing specific needs from a life cycle prospective;

- **Promote cooperation between companies, farms,** universities, research centers, institutions, etc. to foster the reuse or recycling of organic waste and scrap in production processes, as well as the exchange of knowledge, technologies and innovative solutions;

- **Incentivize the sustainability of companies** by promoting the reuse or recycling of circular and biobased by-products, organic waste and secondary raw materials in production processes through measures such as simplified administrative procedures, subsidies for research and development, or tax breaks for investments in all recycling and recovery technologies.

ACTION 3

Enhancing the knowledge as well as the monitoring, sustainable management, protection and restoration of national biodiversity, ecosystems and soils, while strengthening their contribution to fostering national resilience and adaptation to climate changes.

Environment, natural resources, natural capital, biodiversity, ecosystems and ecosystem services are under severe pressure both globally and locally. The European “Biodiversity", “Farm to Fork” and Soil 2030 strategies aim to address these threats and to stimulate the economy, improve the health and quality of life, preserve nature and ensure that no one is left behind. It is therefore imperative that the implementation of Italy’s Bioeconomy contributes to reducing environmental pressures, valuing biodiversity, halting and reversing its loss, and ensuring the achievement of relevant climate targets (i.e., Effort Sharing Regulation, LULUCF regulation).

There are several sources of soil and water pollutants/contaminants that interfere with our eco-systems and enter the food-feed chains (e.g. microplastics, chemical fertilizers and herbicides, lubricants, metals, fuels, antibiotics and excess nutrients), and their use and release into the environment has to be reduced. Reducing soil and land degradation is another priority, as well as promoting the sustainable and responsible management of forests. These actions can enrich natural capital and enhance the provision of main ecosystem services, thus improving the productivity and resilience of natural resources and strengthening the capacity of the Green and Blue Network to provide healthy ecosystem services.

Sustaining nature’s contribution to humanity requires maintaining a healthy planet and resilient ecosystems through the efficient use of natural resources and the conservation and sustainable management of biodiversity. Achieving these objectives requires a deeper knowledge and understanding of ecosystems status, supported by the adoption of cutting-edge technologies based on Artificial Intelligence, and by leveraging high-performance computing and cloud infrastructure and their interactions through the collection of scientific evidence and data on the impact of industrial activities[38], as well as through the valorization of tacit, local and traditional knowledge, to increase foresight capabilities.

The production and application of eco-designed Bioeconomy products (including packaging and labelling) can make a substantial contribution to preserving ecosystem services, provided that they are implemented in a virtuous manner with high-quality input/output flows. These elements are essential for providing the evidence needed to support policymakers and ensure policy consistency. Furthermore, innovative business models are essential, based on a thorough understanding of the opportunities, risks and sustainability limits associated with the management of biological resources.

It is essential to leverage Italy's rich biodiversity (the largest in Europe), along with its economic, cultural and environmental values, to develop new value chains centered on the sustainable exploitation of local biological resources, developed in alignment with the needs and specializations of local communities and stakeholders.

[38] Cfr. e.g. https://www.alleanzaeconomiacircolare.it/wp-content/uploads/2024/01/Industria-biodiversita-ed-economia-circolare_Alleanza-per-lEconomia-Circolare.pdf.

The recommended actions, deemed consistent with the National Biodiversity Strategy**, are:**

- **Protect and increase biodiversity** through appropriate management practices and habitat restoration actions, which must be:
    - aligned with the EU Green Deal targets;
    - focused on the objectives of the EU 2030 Biodiversity Strategy, which requires the protection of 30 % of the marine environment by 2030;

- **Adopt standardized indicators and a methodological framework,** endorsed by policy makers, to measure the value of ecosystem services (e.g. Nature-Based Solutions). This will enable the alignment of national and EU funding mechanisms towards the achievement of these targets;

- **Strengthen the knowledge, resilience and status of biodiversity across terrestrial, wetland, coastal and marine ecosystems,** including the services they can provide and their related socio-economic costs and benefits, with particular attention to regulatory ecosystem services, in line with the Italian Natural Capital Committee (Reports 1 to 5 L. n. 221, 2015 Dec. 28, art. 67), the National Forests Strategy, the National Biodiversity Strategy 2030 (Decree n. 252, 2023 Aug. 3) and the European Biodiversity Strategy to 2030 (COM/2020/380 final). This approach would allow the implementation of an ecosystem-based management strategy for natural resources, valuing the provision of ecosystem services in the frame of environmental policies on the protection of water, soil, biodiversity and habitats, as well as promoting the natural capital accounting systems based on methodologies defined by the United Nations and the European Union, including the Mapping and Assessment of Ecosystems and their Services (MAES) and Forest Information System for Europe (FISE);

- **Improve the National Inventory of Forests and Forest Carbon Stocks:** this action is key for the implementation of an annual reporting and accounting system under the EU Governance Regulation and the UN Framework on Climate Change (UNFCCC). This will contribute to the preparation of the periodic "Report on the state of national forests" (Article 14, Legislative Decree n. 34 of 2018), integrating new administrative, socio-economic and ecological indicators. The final goals will be: i) a better understanding of forest sector dynamics; ii) delivery and information to assess the impact of climate change on the forest sector; iii) to enable informed decision-making; iv) to facilitate reporting commitments deriving from EU legislation and Italy's participation in multilateral processes, such as the UN conventions on climate change, desertification and biodiversity, as well as the 2030 Agenda for Sustainable Development;

- **Update the National Inventory of Wetlands**, thus contributing to the implementation of the Ramsar Convention on Wetlands (ratified and enforced with Presidential Decree of 13 March 1976, no. 448 and subsequent Presidential Decree of 11 February 1987, no. 184). This will be accomplished also through the use of novel technologies, such as remote sensing and other methodologies, which will allow a better understanding of the evolution of wetlands, including those receding and reclaimed. The resulting data will be made available to decision-makers, in order to facilitate reporting commitments deriving from EU legislation and Italy’s participation in multilateral processes, such as the Ramsar Convention and the Convention on Biological Diversity (CBD). Ultimately, these will facilitate the assessment of carbon capture and storage capacity, as well as the value of corresponding carbon credits at the national, regional and site-specific levels;

- **Integrate monitoring and data systems and select key indicators for the sustainable management of land, water and marine biobased production, to comply with environmental assessments and**

promote the adoption of evidence-based measures and regulations. This action will enhance the monitoring and reporting capabilities on the condition of national biodiversity, ecosystems and ecosystem services, to underpin ecosystem conservation and restoration by leveraging data and information services from the Copernicus and European Marine Observation and Data network (EMODnet);

- **Assess the national role of pollinators and microbiomes** as enabling factors in preserving soil biodiversity and ecosystems, increasing crop productivity and biomass quality, and improving food quality, safety, shelf-life and functionality. The national initiative on microbiomes launched by CNBBSV in 2018 and implemented with a Position Paper and an industrial Implementation Action Plan[39], will guide some of the activities related to this action;

- **Promoting the approach to sustainable use of soil and land is essential for ensuring a healthy planet** for future generations. Sustainable land use, including the restoration of degraded soils, represents the main nature-based solution to improve the functionality of ecosystems and landscapes, with positive effects on livelihoods and soil productivity, in synergy with the agricultural sector.
  In particular, **the following sub-actions are proposed in this sector**:

  - **Monitoring of degraded land areas or lands at risk of climate change** impacts (e.g. desertification) in cooperation with Copernicus services and the Sentinel system. This monitoring will underpin actions to improve soil health through circular Bioeconomy regenerative practices;

  - **Reuse and recovery of degraded lands for the implementation of Bioeconomy value chains**, also contributing to the use of National Fund aimed at contrasting land consumption;

  - **Promotion of productions that improve soil functionality** (in line with soil descriptors outlined in the proposed Directive on soil monitoring and resilience), and ecosystems services provision;

  - **Support the development of an appropriate legislative framework for soil** health and sustainable land use, including a zero-net land take policy, to enhance sustainable production and multifunctionality of territories, in line with the European Directive proposal on soil monitoring and resilience;

  - **Contribute to the creation of an effective soil monitoring system,** in line with the European Mission “A Soil Deal for Europe”, to support the development of national policies and appropriate models and frameworks for assessing the sustainability of supply chains and bio-products, with particular attention to land use, quality, productivity and ecosystem services.

[39] https://cnbbsv.palazzochigi.it/en/Bioeconomy/microbiome/.

ACTION 4

Promoting territorial reconnaissance actions to better co-design site-specific, tailored actions for restoring, regenerating and upgrading local Bioeconomy value chains.

In alignment with the national BIT II strategy, local and regional initiatives play a pivotal role in addressing specific challenges and requirements, and in exploiting the opportunities of the diverse economic landscapes composing the Italian Bioeconomy. **Therefore, mapping and prioritizing local needs, in collaboration with both public and private actors, is essential for a successful implementation of Bioeconomy across the territories**.

Fundamental Components of this action are:

1. Enhancing digital transitions applied to the Bioeconomy sector through:

- Establishing a Comprehensive Database/Information System to assess, harmonize and make available data on local Bioeconomy gathered during reconnaissance activities, thus creating the foundation for more tailored improvements in policies, measures and instruments;

- Widespread Dissemination of Data and Reports: upon the completion of reconnaissance activities, findings, insights, and recommendations garnered should be disseminated extensively among pertinent stakeholders, including policymakers, industry and business associations, and research and innovation communities. This ensures transparency and fosters a collective understanding of the prevailing challenges and opportunities within the regional Bioeconomy landscape. The dissemination will be implemented through reports and communication campaigns;

- **Encouraging companies to adopt AI in Bioeconomy processes and biomanufacturing**, while considering the benefits of European measures proposed in the AI package[40] (AI factories, etc.) and gain access to supercomputers for startups and the broader innovation community.

2. Commissioning Research and innovation actions to Specialized Entities, jointly identified by regional authorities, clusters and the central government**.** Research and innovation tasks should be assigned to esteemed research institutions or specialized entities active in Bioeconomy domains through a transparent and competitive tendering process overseen by regional authorities. Such Entities can be linked to emerging Regional Innovation Valleys (RIVs)[41].

3. Sensitization and Capacity Building for Businesses: recognizing the pivotal role of capacity building in driving innovation and competitiveness, targeted sensitization and training programs should be developed for businesses across the different Bioeconomy domains. These programs aim to heighten awareness regarding emerging trends, technological advancements, and best practices, thereby empowering companies to make informed decisions on upgrading their production chains, adopting sustainable practices, and contributing to *smart grids* for energy distribution;

4. Identification of Emerging Needs and Policy Formulation: building upon the insights gleaned from reconnaissance activities, regional authorities, in close cooperation with public and industrial stakeholders, identify and prioritize the emerging needs in the different Bioeconomy sectors.

[40] Commission launches AI innovation package: https://ec.europa.eu/commission/presscorner/detail/en/ip_24_383.
[41] https://projects.research-and-innovation.ec.europa.eu/en/strategy/support-policy-making/shaping-eu-research-and-innovation-policy/new-european-innovation-agenda/new-european-innovation-agenda-roadmap/selected-regional-innovation-valleys.

Subsequently, tailored policy initiatives are developed, encompassing regulatory reforms, financial incentives, and collaborative research and development endeavors aimed at fostering innovation, sustainability, and competitiveness within the regional Bioeconomy ecosystem;

5. Enhancement of Regional Collaboration and Systemic Capacities: regional authorities facilitate the establishment of collaborative networks, clusters, and platforms that bring together companies, research institutions, government agencies, and other relevant stakeholders. By fostering a culture of knowledge exchange, resource sharing and collective problem-solving, these initiatives enhance the region's ability to leverage its collective strengths, specificities and resources, thereby promoting innovation, resilience, and competitiveness within the local Bioeconomy;

6. Tailored Application Process for Local Enterprises: a streamlined and accessible application process designed to meet the specific needs and characteristics of local enterprises is implemented to upgrade their production chains. Regional authorities collaborate closely with industry representatives and business support organizations to create user-friendly application procedures that minimize bureaucratic hurdles and provide timely guidance to applicants. Additionally, capacity-building initiatives are offered to equip local enterprises with the skills and knowledge necessary to navigate the application process effectively and maximize the benefits of available support mechanisms.

ACTION 5

Promoting awareness, skill upgrading, education, attitude, training and entrepreneurships across the Bioeconomy sectors.

To contribute to the growth of the Italian Bioeconomy in an environmentally sustainable and integrated manner, a series of initiatives is required to connect internal economic sectors, extending value chains and creating new ones, and to increase awareness and commitment among citizens and businesses, thus improving education, training, communication, information, entrepreneurship, etc.

To better disseminate the principles and knowledge of the Bioeconomy as a system for achieving environmental, social and economic sustainability objectives, particularly towards citizens, starting with school-age children, a dedicated **Working Group on Education & Communication** within the NBCB will be created in order to jointly leverage the potential of public administrations, research bodies, educational institutions, Regions, technological clusters, and private sector companies in the areas of training, communication and citizen engagement, in line with the relevant SDGs and ESGs agendas.

The recommended actions are:

TRAINING

- **Integrate Education and Training Programs**. Develop training modules that allow teachers to connect different disciplines to Bioeconomy principles at all levels, from primary school to university, thus encouraging the development of key skills and integrate existing ones. Collaborate with educational ministries and business worlds to create interdisciplinary and practical modules that promote sustainable innovation and bring out successful practices already implemented in the area;
- **Systematize European and Italian projects and initiatives**, including those promoted by APRE (Agency for the Promotion of European Research)[42], to set up: i) new Bioeconomy-focused training courses in close cooperation with the Ministry of Education and Merit; ii) additional curricular initiatives in universities (Master degrees, doctorate degrees, etc.) in close cooperation with the Ministry of University and Research; iii) ITS (HTI, Higher Technical Institutes) initiatives focused on the development of Bioeconomy-related skills; iv) pilot projects in regional programming to include Bioeconomy pathways; v) connect all these initiative to the European Deep Tech Talent Initiative.
- **Improve employee training and education** – particularly of the ones working in Italy's agricultural, food, forest, water, wetland and marine/maritime sectors - to meet needs and transformations of Bioeconomy sectors, facilitating the replacement of aging workers in the mentioned sectors (e.g. technicians, support engineers, ground-staff) with younger, better-trained professionals who possess multidisciplinary, digital, managerial and cross-sectoral expertise;
- **Incorporate Bioeconomy in education in both school curricula and vocational programs** (such as agronomy, wood and forestry, chemistry and biology, agriculture, marine and maritime studies and food sciences);
- **Train the students by** incorporating Bioeconomy concepts and applications into the civic education curriculum;
- **Provide schools with guidelines within the PCTO** (Pathways for Transversal Skills and

[42] https://apre.it/en/homepage/.

Orientation) to implement internships, specific courses, and hands-on experiences in the Bioeconomy sector with companies;

- **Raise awareness and promote Bioeconomy topics in ITS (Higher Technical Institutes) and IFTS, encouraging them to** incorporate experiential learning and applications into their training programs, integrating local business skills;
- **Integrate Higher Education programs with industry** and support the collaboration between IFTS and ITS systems (i.e. VET - Vocational Education and Training systems);
- **Intensify mobility between academia**, authorities and industry to build a blue human capital and to attract cutting-edge professional skills within a wide range of biological, technological and social science fields to create a cross-disciplinary and cross-sectoral Bioeconomy workforce;
- **Promote and support innovative models and initiative for upskilling** and reskilling **workers** to introduce new human resources, with a focus on talent attraction and retention, such as the Deep Tech Talent Initiative;
- **Spread a culture of safety at forestry sites** and continuing worker education around new logging technologies ensuring compliance with laws and collective bargaining agreements, particularly by directly involving forestry workers in this process;
- **Monitor,** based on the existing mapping, **the national Bioeconomy study programs**, evaluate the current curricula and create, if necessary, new Bachelor's and Master's University degree programs in Bioeconomy. Additionally, better promote existing ones to contribute more effectively to the smart, innovative multidisciplinary and sustainable Bioeconomy growth in the country. This will also require support from collaborative networks of academic institutions and private sectors to share best practices and improve the development of Bioeconomy curricula.

CITIZENS & PUBLIC COMMUNICATION

- **Promote public awareness and engagement** through campaigns showcasing Bioeconomy models and products, particularly those related to sectors like wood and food, which are emblematic of sustainable value-chains in terms of carbon neutrality, adoption of circular economy and sustainable production practices such as sustainable fishing and livestock, responsible forest management and alternative energy resources;
- **Promote public outreach events to raise consumer** awareness of Bioeconomy strategies and opportunities (including promoting the purchase of lesser-known, under- exploited species to protect declining fish stocks, etc.);
- **Promote targeted and engaging communication campaigns** to broaden awareness and strategic communication of the Bioeconomy and its potential, along with the participation of main television broadcasters, national newspapers and magazines specialized in economics and the environment;
- **Promote a mobile exhibition on** Bioeconomy in day to-day life, organize "**open days**" at companies active in the Bioeconomy, and support initiatives such as National Bioeconomy Day, launched by SPRING Cluster and Assobiotec-Federchimica in collaboration with the National Technology Cluster for Agrifood CL.A.N., thus contributing to all other initiatives aimed at raising public awareness, including campaigns to implement the quality of waste separation and increase material recovery performance;
- **Leverage the construction of the Olympic Village for the 2026 Games** (Milano-Cortina) to showcase Italy's excellence in Bioeconomy. Utilizing biobased materials (such as wood, hemp and bioplastics) for the construction of the Olympic Village could serve as an opportunity to demonstrate

the benefits of circular Bioeconomy principles and application and pave the way for green public procurement in this sector. Additionally, **establish a registration/labelling system** for these materials so that the life cycle of the objects and their main environmental impacts are identifiable.

ENTREPRENEURS & COMPANIES

- **Promote the constitution of** "**Bioeconomy Innovation Clusters**" in Italian regions and areas where the presence of natural biomaterial could drive economy growth and social sustainability;
- **Promote an entrepreneurial mind-set and culture for the Bioeconomy** through the contribution of various Knowledge Innovation Communities (KICs) launched by the European Institute of Innovation & Technology (EIT). These include EIT Raw Materials, EIT Food, EIT Climate-KIC and EIT InnoEnergy, EIT Manufacturing, and the newly launched EIT Water Marine and Maritime;
- **Promote collaboration** with European partnerships, including Circular Biobased Europe and Sustainable Blue Economy;
- **Promote Open Innovation initiatives to accelerate the scaling-up of innovative solutions** in the Bioeconomy field, developed by startups and SMEs, and Bioeconomy i**nnovation clusters** , supported at the national, regional, and/or interregional levels;
- **Promote Italy's technology transfer strategy in the Bioeconomy by leveraging the network** of Competence Centers, Digital Innovation Hubs and enhancing the protection of industrial property;
- **Act to increase EU financial support for Bioeconomy projects** in line with recommendations from the European Investment Bank on "Access-to-finance conditions for Investments in Biobased Industries and the Blue Economy", as well as the European Sustainable Finance Framework. This aims to improve access to finance by helping projects improve their bankability and investment-readiness, financing structures and connections with private investors;
- **Exploit the training and innovation outcomes from the three National Centers related to Bioeconomy funded through Next Generation EU grants to generate new entrepreneurship**:

1) The **National Biodiversity Future Centre focuses on the Mediterranean area** (a biodiversity hotspot) and addresses global challenges related to the protection and restoration of marine, coastal, transitional and terrestrial ecosystems: specifically, it promotes the development of practices for monitoring, conservation, valorization and restoration of biodiversity, including genetic and functional aspects, to counteract the effects of anthropogenic impact and climate change, while supporting ecosystem services. The Centre also supports research and innovation aimed at enhancing biodiversity through processes of circular economy and restoration ecology and economy, with the primary objective of protecting the resources provided by ecosystems.

2) The National Centre for Agritech, coherently with the recently published report of the 5th SCAR (European Commission's Standing Committee on Agricultural Research) ("Resilience and transformation"), is promoting training, research and innovation in: 1) ensuring nutritious, healthy and sustainable food for all; 2) achieving full circularity in food and agricultural systems; and 3) restoring diversity in food, farming and social systems.

3) The National Centre for HPC, Big Data and Quantum Computing is setting up a national computing infrastructure that integrates existing High Performance Computing (HPC), High Throughput Computing (HTC), Big Data and network infrastructures, along with new targeted resources procured by providing scientific and industrial communities with a flexible and uniform Cloud interface to serve the full spectrum of applications, ranging from HPC computing to the development and implementation of digital twins and data storage, also contributing to the implementation of a more sustainable and regenerative Bioeconomy.

OBSERVATORY & PORTAL ON BIOECONOMY (OPB)

The establishment of an **Observatory and of a Portal on the Bioeconomy (OPB),** building upon the various initiatives outlined above, will help:

(i) **collect and share data and scientific evidence** in favor of an integrated and diverse approach to Bioeconomy solutions, highlighting in a critical and constructive way a wide range of best practices from different companies across territories, as well as listing research and innovation projects on Bioeconomy products and their applications, which can provide both practical and conceptual frameworks for sustainable innovation within Italy's Bioeconomy strategy;

(ii) **raise awareness of products obtained from biobased feedstock** and their externalities among retail and agri-food companies, enabling them to promote and offer more of these products to consumers;

(iii) facilitate **technical information campaigns for each major family of products obtained from biobased feedstock** (e.g. hygiene, construction, clothing) **aimed at downstream actors** in supply chains;

(iv) **enable monitoring activities and evaluation processes** for training, education and communication efforts, improving their overall impact, evaluating the existing curricula, and creating, if necessary, new Bachelor's and Master's University degree programs in Bioeconomy, as well as better promoting existing ones;

(v) contribute in a more effective way to smart, **innovative, multidisciplinary and sustainable Bioeconomy growth** in the country, also by supporting collaborative networks between academic institutions and private sectors, to enhance the exchange of best practices and improve the development of Bioeconomy curricula.

PUBLIC ADMINISTRATIONS & REGIONS

- **Increase and systematize the number of regional Bioeconomy strategies** and positioning papers, while creating regional public and/or private contact points.
- **Promote Bioeconomy culture and expertise within Public Administration** by participating in European initiatives and networks, such as Vanguard Initiative, European Regions Research and Innovation Network, S3 Thematic Platforms and Regional Innovation Valleys;
- **Promote biobased culture** by using funds generated from administrative sanctions imposed by the Competition and Markets Authority, which are intended for consumer-benefiting initiatives;
- **Develop policies to foster innovation**, facilitate technology transfer and promote their adoption to enhance global competitiveness or maintain leadership, while also focusing on the attractiveness of industrial investments;
- **Support or establish (if not already present) local innovation ecosystems** (e.g., clusters, innovation poles, technopoles, regional hubs) by integrating Bioeconomy into their strategic research and innovation agendas;
- **Launch a "Sustainable Bioeconomy" Information System (SuBIS) that is** interoperable and regionally structured, and, in collaboration with OPB, will constitute an entry point for sharing information on the state and development of the main national sustainable Bioeconomy actions, while also highlighting Italian Bioeconomy excellence and best practices. The system could collect and organize data, information and knowledge gathered or derived from key Bioeconomy-related policy

drivers. It will be also important to promote science-based information on the advantages of Bioeconomy products, to properly inform citizens.

FLAGSHIP PROJECTS TO BE DEPLOYED IN THE SHORT-TERM

A consultation launched by the National Technology Clusters for Agri-food, Circular Bioeconomy, Blue Growth and Forests & Wood, all core actors within the NBCB, has so far resulted in a set of ready, concrete, replicable projects which, if properly catalyzed and supported by public-private investments, could significantly contribute to the national transition towards a more sustainable Bioeconomy.

These projects are aimed at:

- **Adapting existing or developing new infrastructures for the recovery and utilization of organic waste, urban and industrial waste, wastewater and sludges, transforming them into valuable organic matter (such as nitrogen and phosphorus) and other nutrients**;
- **Constructing efficient District Heating (DH) systems** based on the valorization of wood raw materials, via the extension of existing networks, possibly upgrading the available power plants, and constructing new ones;
- **Creating new territorial value chains by establishing national, multi-input, multi-product biorefineries capable of utilizing biomass from crops which are not in competition with the food supply chain** (i.e., intermediate crops, crops grown on marginal lands and areas, etc.) **and local waste, residues and co-products from agro-industrial value chains**, to produce sustainable, biobased and biodegradable products while preventing pollution from liquid and solid carbon feedstocks;
- **Strengthening the domestic forestry economy**, particularly in mountain areas, by boosting supply chains and transformation pathways based on nationally sourced raw materials and by producing advanced, high-value wood-based products;
- **Integrating and valorizing agro/urban/industrial biomass, co-products and residues** (such as waste and by-products) to the production of chemicals, materials, high value products, biomethane and biofuels. Renewable gases for industrial uses, sustainable biofuels for decarbonizing the transport sector, Sustainable Aviation Fuels (SAF) and maritime sustainable biofuels will provide both environmental and economic benefits for local territories;
- **Totally or partially reconverting** traditional refineries, chemical plants and other industrial sites into biorefineries, in synergy with local agroforestry production and needs, to produce biochemicals, biobased materials and energy of both national and international interest;
- **Relaunching agrifood districts and supply chains** to integrate and share common activities, as well as sustainable food design. This includes valorizing the Made in Italy through regenerative agriculture, innovative food packaging solutions and healthy diet initiatives;
- **Restoring and protecting marine habitats by strengthening the national system for the observation of marine and coastal ecosystems**, as well as the mapping of coastal and marine habitats;
- **Promoting industrial symbiosis within the Bioeconomy landscape**, enhancing synergies between local economic actors to improve both environmental and economic efficiency by turning waste from one actor into a resource for another, thereby valorizing residues and recovering energy.

There are several reliance-driven elements on which the proposed projects across Italy's national territory are based, as outlined below:

- **Synergy between rural, mountain, coastal, wetland, industrial, and urban areas, thus overcoming the competition for resources**: interventions aimed at growth and innovation of the circular Bioeconomy are not designed to promote a single production sector territory but rather to **enhance the competitiveness of entire value chains**. Agricultural, food, forestry, wetlands, fishing, wastewater and waste management sectors are involved both upstream and downstream. Firstly, as bio-resource suppliers, and later as recipients of technologically advanced, low impact, biobased and eco-designed products. These products, such as sustainable packaging, are necessary to preserve and increase the shelf-life of food and agricultural products, making local supply chains more sustainable, and protecting the health of consumers and workers, etc.;

- **Transformation of costs into value**: the virtuous interconnection of various economically significant national realities, previously exposed to the market as isolated and independent realities, allows **to transform costs (e.g. waste disposal, by-products management, etc.) into value. Conversely, this value is maintained within national territory,** thus encouraging the creation of industrial symbiosis and bio-circular economy practices in areas where they have yet to be implemented;

- **Development and growth with the territory and not in the territory**: the creation of circular Bioeconomy value chains, catalyzed by incremental innovation, promotes a **cohesive and sustainable development, also through trans-regional coordination, which enhances the specific characteristics of systems in each territory;**

- **Terrestrial and marine ecosystem restoration**: Bioeconomy allows to reduce emissions, increases land and aquatic CO_2 sequestration, and contributes to prevent or contain chemical pollution, allowing the sustainable disposal of organic waste and wastewater from both civil and industrial sources, leading to the **production of biodegradable and compostable materials that do not accumulate in soil and water and which, at the end of their lifecycle, can be transformed into organic matter that sustains soil and hydrosphere productivity.**

FLAGSHIP 1 – CREATION OF NEW LOCAL AND REGIONAL VALUE CHAINS INTERCONNECTING RURAL AND/OR MARGINAL LANDS THROUGH THE IMPLEMENTATION OF MULTI-INPUT, MULTI-PRODUCT BIOREFINERIES WHICH INTEGRATE BIOTECHNOLOGICAL AND CHEMICAL PROCESSES AND BIOMASS POWER PLANTS

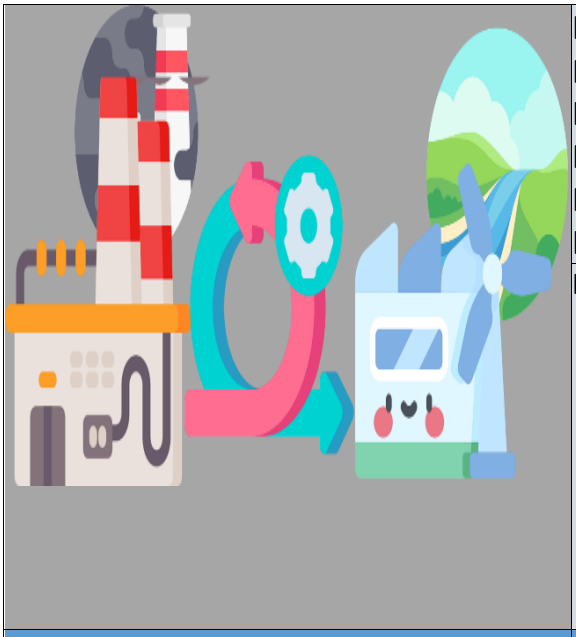
INVESTMENT	**~ € 150 M**

TARGET	**EXPECTED IMPACTS**
Develop **multi-purpose, multi-product biorefineries and other biobased and biochemical processes capable of converting, through biotechnological and/orchemical processes, biobased feedstock into low-impact chemicals products and materials and sustainable bioenergy, conceived as solutions designed to produce novel, innovative or, when required, biodegradable products, thus reducing emissions and minimizing environmental impact.** In this perspective, the establishment of **supply chains aligned with Bioeconomy principles and the cascading approach, based on sustainable biomass (e.g. agroforestry biomass, intermediate crops, crops grown on marginal and degraded lands and areas, biowaste and by-products from the agri-food, livestock, forestry, marine and maritime sectors, as well as municipal organic waste and biological sludges from wastewater treatment),** represents **an effective solution for revitalizing soil productivity, regenerating fragile territories, especially in Southern Italy (also through the integrated growth of industrial and food crops**). **New business models can be generated from synergies between the agricultural and industrial sectors**. This approach creates opportunities to valorize **additional agricultural, wetland and/or forestry by-products, as well as waste** and non-food **marine biomass and byproducts, valuable sources of high biological potential and high value molecules and substrates for bioenergy production.** A key objective is to **promote the wood economy in mountainous areas** by utilizing wood and wood residues obtained from sustainable forest management, following the **cascading principle, along with the efficient production of bioenergy to promote local autonomy from fossil sources and** fossil or fuel-based heating systems.	▪ **Creation of new jobs, many of which specialized, both in primary production sectors and within the biorefinery itself.** ▪ Generation of new income **sources for players in the primary and secondary sector, along with the enhancement of districts/territories.** ▪ Initiation of **highly specialized production chains, which can also be replicated in different production contexts**. ▪ **Recovery and restoration of marginal, abandoned or degraded/deserted lands, including the** prevention of hydrogeological instability through their rehabilitation. ▪ **Development of industrial-scale technological solutions** for **the implementation of innovative biorefineries.** ▪ Obtaining **bioproducts and/or high added value molecules** with significant market potential, along with renewable gas and biofuels. ▪ **Reduction of dependence of the chemical and fuel sectors on fossil feedstock.** ▪ Reduction in **costs related to the management and disposal of organic waste and residues from various agro-industrial sectors, while generating value.** ▪ Creation of **supply chain certification systems** to guarantee marketing of developed bioproducts. ▪ **Support forestry businesses through investments** and promote training programs to counteract the processes of abandonment, closure, aging and lack of generational turnover. ▪ **Promotion of sustainable forest resource use** within renewable energy communities, leveraging both new and existing plants, through economic support and related subsidies. ▪ **Support the large-scale use of certified, soil biodegradable** mulching films in agriculture.

FLAGSHIP 2 – BIOREFINERIES TAILORED TO THE SPECIFIC SOURCES OF RENEWABLE CARBON IN LOCAL TERRITORIES: INTEGRATED VALORIZATION OF AGRO/URBAN/INDUSTRIAL BIOLOGICAL WASTE, RESIDUES, CO-PRODUCTS AND BYPRODUCTS

INVESTMENT	**~ € 250 M (for upgrading of existing plants) + € 880-1.760 M (for new plants for anaerobic digestion and composting, primarily in southern Regions).**

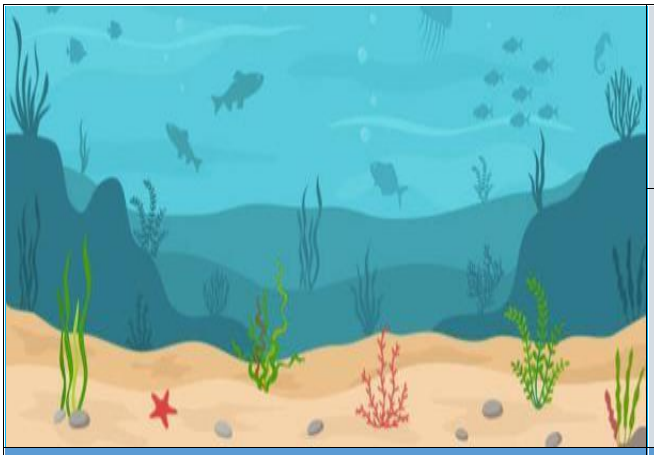
TARGET	EXPECTED IMPACTS
Developing industrial bioeconomic solutions for the valorization of biological waste and residues/byproducts deriving from agrifood sectors, as well as from industries and urban bio-waste management, integrating them in the production process. **This would also allow the production of safe and sustainable bioproducts, along with marketable by-products** (e.g., **natural organic soil improvers, renewable mineral and organo-mineral fertilizers, biochar, bio stimulants, renewable biochemicals and bioproducts, biomethane and biofuels, bio and biochemical gases, liquefied gases, CO_2, power and heat,** etc.). **In addition, to promote measures, including fiscal incentives, for the construction of new efficient District Heating (DH) systems based on the valorization of wood raw materials, along with the upgrading of existing power plants (by installing thermal storage), and the construction of new power plants.**	▪ New business and employment opportunities for all sectors involved in the supply chain (e.g., waste management, multi-utilities, technology and process development, large, small and medium-sized enterprises, innovative start-ups, trade associations, research and technology transfer centers). ▪ **Significant reduction**, in line with the circular economy package, of the challenges associated with the disposal of urban-origin biological waste, such as OFMSW, anaerobic digestates, sewage sludge, pruning clippings, etc. ▪ **Transformation** of municipal wastewater sludge into quality compost and a source of phosphate, through advanced processing. ▪ **Significant reduction** in the amount of waste generated during the processing of biological waste. ▪ **Adaptation** of technologies and methodologies to existing, underutilized plants (e.g. anaerobic sludge digesters in wastewater treatment plants). ▪ Reduction of climate-changing emissions associated with current treatment processes, and enhancement of Total Organic Carbon storage into soils. ▪ **Implementation** of advanced, innovative technologies aimed at optimizing organic waste recycling, in line with the EU target (i.e., 65 % of municipal waste recycled by 2035). ▪ **Maintenance and improvement** of ecosystemic services in agricultural, urban and industrial soils. ▪ **Valorization of local renewable carbon sources, thus ensuring energy security and reducing dependence** on fossil sources.



FLAGSHIP 3 – BIOECONOMY AND BIOREFINERIES FOR THE REGENERATION OF INDUSTRIAL SITES: FULL OR PARTIAL RECONVERSION OF TRADITIONAL FOSSIL OIL REFINERIES, CHEMICAL PLANTS AND OTHER INDUSTRIAL SITES.

INVESTMENT	**~ 500 M € for the reconversion of a traditional refinery into a biorefinery.** National legislation establishes an investment support regime for the full or partial reconversion of existing traditional refineries, allocating 260 million € (Fund for the decarbonization and green reconversion of existing refineries). The criteria and methods for implementing the measure and allocating the resources will be defined in subsequent MASE/MEF (Ministry of Economy and Finance) decrees.

TARGET	**EXPECTED IMPACTS**
Reconvert traditional refineries and non-productive/competitive industrial plants into biorefineries to meet the specific needs of innovative biobased production value chains, also **in synergy with the agrifood sector, urban ecosystems** and waste and residues management. Incentivize the use of available spaces within industrial sites to develop new plants for biomass/waste processing and the production of bioproducts, biochemicals, and biofuels, including chemical and liquefied gases. **Upgrade** existing biorefineries by implementing cutting-edge technologies that meet high sustainability and productivity standards.	▪ **Creation of new jobs, many of which specialized, both in the primary sector for biomass production and management, as well as within biorefineries and other bio and biochemical processes.** ▪ **Revitalization of the local economy through the integration of local supply chains in order to fully valorize agro/urban/industrial biomass.** ▪ **(Bio)Remediation of associated polluted areas to ensure their recovery for productive use.** ▪ **Reduction of territorial and landscape degradation.**



FLAGSHIP 4 – MARINE ECOSYSTEM RESTORATION AND STRENGTHENING OF THE ITALIAN MARINE OBSERVATION SYSTEM.

INVESTMENT	**€ 400 M.** This is a recently funded next generation EU project, currently under implementation and set to be completed by the end of 2026. **Follow-up actions must be planned to ensure its sustainability over time.**

TARGET	EXPECTED IMPACTS
This investment includes large-scale actions for the restoration and protection of the seabed and marine habitats, aimed at reversing the ongoing degradation of these ecosystems. Specific actions include the **complete mapping of deep seafloor habitats and seamounts within Italy's territorial and protectional ecological zones, as well as the coastal habitats along the entire Italian coastline, using state-of-the-art LIDAR technologies**. To ensure the adequate planning and implementation of large-scale restoration and protection measures, **the national research and observation system for marine and coastal ecosystems is being upgraded with offshore and coastal buoys, coastal radar monitoring stations, sea-level and physico-chemical monitoring stations in the Venice Lagoon, and an AUV system.** An oceanographic research vessel will be acquired, equipped with the most advanced available technologies, including a work-class ROV operating at depths up to 4000 meters, featuring a silent class and diesel-electric propulsion capacities, ensuring to maximize pollution prevention and control. This initiative, set to conclude in 2026, will need to be followed by new projects to promote the valorization of passive and active restoration efforts conducted in Italy, in order to actively pursue the objective set out in the EU Nature Restoration Law.	▪ **Reverse the ongoing degradation of marine ecosystems.** ▪ **Assess the effectiveness of protection and management measures in the context of climate change scenarios.** ▪ **Enable systematic and comprehensive mapping of sensitive habitats in Italian marine waters.** ▪ **Provide up-to-date mapping of the Italian coastline to facilitate the planning of cost-effective measures to mitigate coastal erosion.** ▪ **Improve modeling capabilities to develop reliable climate change scenarios and assess climate change impacts for Italy and the Mediterranean Sea.** ▪ **Provide up-to-date monitoring data for the planning and development of renewable energy production plants, such as offshore wind farms.** ▪ **Accelerate the understanding of deep-sea habitats at an unprecedented pace, unlocking potential applications for the development of biotechnologies based on new substances and/or organisms.** ▪ **Improve industrial technological capacities to map and monitor both coastal and offshore marine ecosystems.** ▪ **Implement environmental restoration and designation of new marine protected areas, in line with the Marine Strategy Framework Directive, the 2030 EU Biodiversity Strategy and the EU Nature Restoration Law.**

FLAGSHIP 5 – SUSTAINABLE FOOD DESIGN: VALORIZING MADE IN ITALY THROUGH REGENERATIVE AGRICULTURE, INNOVATIVE FOOD PACKAGING SOLUTIONS AND HEALTHY DIETS.

INVESTMENT | **€ ~ 50 M**

TARGET

Italy is a leader in packaging recycling at the EU level.
In 2023 Italy recycled 75.3% of packaging waste from approximately 14 million tons of packaging released for consumption (Data CoNaI – National Packaging Consortium).
For this reason, the paradigm shift from 'recycling' to 'reuse' under the Packaging and Packaging Waste Regulation (PPWR) has raised concerns for its potential impact on Italy's virtuous recycling model and its negative consequences for the Italian agri-food system.
This is why Italy fought to obtain a series of corrective changes to the Regulation's text, leading to the introduction of some exemptions.
One of these derogations allows Member States that are recycling "champions" to exceed the 2025 recycling target of 65% (as set by the Waste Framework Directive) by 5 percentage points and are expected to exceed the recycling target of 70% for 2030 by 5 percentage point as well.
This derogation acknowledges the efforts made by countries like Italy that have heavily invested in recycling over the years to meet EU criteria, introducing an awarding criterion rather than penalizing them.
Italy has to meet the requirements to qualify for this derogation.
However, it is of utmost importance to continue investing in order to consolidate and build upon the progress made, ensuring that the targets for all materials are met as soon as the regulation comes into force and in the years to come (the derogation must be renewed every five years).
This flagship seeks to redesign and valorize Italian agri-food products, enhancing their sustainability by improving nutritional and sensory properties, as well as **optimizing food packaging.**
The Food Design methodology enables to evaluate the expectations of citizens/consumers and agri-food farmers and companies, guaranteeing that food products are sustainably produced, within the ethical and value-driven agri-food systems inherent in the Mediterranean Diet culture, including the priority to extend product shelf-life, thus reducing food waste.

EXPECTED IMPACTS

- **Significant improvement in the socio-economic and environmental sustainability of Italian food products, including** the **valorization of new by-products, reformulated products, as well as innovative food packaging solutions which will enable new consumption patterns and models, and will contribute to reduce food waste.**
- **Increased awareness among Italian food producers on how to adopt innovative strategies and interventions in the light of food sustainability and the implementation of new food-related projects.**
- **Development of agri-food systems that follow the principles of regenerative circular Bioeconomy**.
- **Management of innovation for the eco-design of packaging to comply with the ambitious challenges and targets set by the PPWR Regulation (i.e. increasing bioplastics, compostable packaging, plastic recycled content, reduction of overpackaging).**
- **Strengthening connections between the agri-food businesses and the scientific and technological research world in order to test innovative food packaging materials (use of nanotechnologies and natural bioactive compounds in packaging)**

The design of certain food products and consumption models will be planned to promote innovative food packaging solutions **to consolidate and improve recycling rates**, increase food accessibility, ensure nutritional adequacy and promote farming practices that favor **regenerative agriculture, soil health, biodiversity and carbon sequestration**. **This action will allow the establishment of virtuous networks** connecting farmers, companies, packaging manufacturers, researchers, and experts/stakeholders from various fields. **It proposes a modern and innovative vision of the Mediterranean Diet and Italian culinary traditions**, promoting both traditional Italian productions and the integration of **sustainable and innovative food packaging eco-design.** "The Flagship will be implemented through the Hub for research, innovation and technology transfer between CL.A.N., PRIMA, Agritech, OnFoods, METROFOOD-IT and Federalimentare. **The Hub will be set up to**: - create a system that serves businesses and institutions; - enhance and ensure the long-term sustainability of initiatives under the aegis of the Ministry of Universities and Research; - develop joint initiatives of interest to the agri-food system, based on agreed-upon needs, timelines and mutual commitments, and carried out at the national and EU levels, with a special focus on the Mediterranean area, including: research activities, technological development, innovation transfer and demonstration (in alignment with national and European projects and calls for tenders); provision of service activities (studies, research and experimentation); training, scientific communication, promotion of debates, seminars, conventions and congresses at all levels to update, inform and disseminate of activities related to the agri-food system".	**and to improve both mechanical and functional properties and performance of food packaging, thus positioning Italy as a leader in innovation in this field.** • **Improvement of food quality for specific target population groups to promote food accessibility and ensure nutritional adequacy.** • **Revitalization of certain typical/traditional Italian productions (PDO, PGI, STG).** • **Use of locally sourced productions to support regional farmers and reduce the carbon footprint associated with long-distance transportation and logistics.** • **Creation of new business opportunities for younger generations, who are currently highly attentive to sustainability issues.** • **Revival of the Mediterranean Diet: a new, modern, updated proposal for our Mediterranean Diet.** • **Creation of new jobs, as companies will need eco-design experts and new skills in food packaging design to comply with the ambitious challenges and targets set by PPWR Regulation.**

FLAGSHIP 6 – IMPLEMENTATION OF "FOREST VALORIZATION HUBS" WITH LOCAL SUPPLY CHAINS FOR A FULL DEVELOPMENT OF THE WOOD-BASED BIOECONOMY.

INVESTMENT	€ ~ 30 M

TARGET

The project aims to fully integrate the national wood sectors into the Bioeconomy implementation process, by including all national forestry supply chains, whether initiated or in their start-up phase.

To accelerate the development of such initiatives, support is needed for the establishment of high-tech logistics centers: "Forest Valorization Hubs".

They will be responsible for managing, processing, transforming and valorizing forest raw materials, in accordance with the cascading principle. Accordingly, the resulting residues will be used and transformed into value within the appropriate value chains ("the right wood in the right supply chains").

The project aims to enhance every aspect of sustainable forest management and to increase the competitiveness of the entire system, starting with the areas where forests are present, especially mountainous territories, which suffer from depopulation due to a lack of skilled jobs opportunities for the new generation.

The project will follow a public-private investment process in order to create a local participatory pathway, with a view to structuring a coordinated and monitored national network, within which information from individual hubs is shared and analyzed, thus enabling a continuous improvement of the entire system.

EXPECTED IMPACTS

- **Develop at least no. 10 "Forest Valorization Hubs"** in strategic locations across the country, based on the presence of forests and biomass to be valorized.
- **Significantly increase the volume of national wood supply** within the different supply chains;
- **Recruit at least 50 people** within the Hub network and the national management and coordination entity.
- **Activate the involvement of all national supply chains**, from construction to panels (including conglomerates and cork), and from energy to green chemistry, through a coordinated plan for wood resource use, in order to ensure economic and social sustainability of territories, including agroforestry systems (e.g. silvopastoral).
- **Map and analyze the CO_2 stock in wood** that will be used for buildings or other long-term applications.
- **Stimulate the attractiveness of mountain areas** as desirable locations for living and working, thanks to the presence of technologically advanced hubs and connection to nature.
- **Reduce the state of abandonment and neglect of forests** that are not sustainably and responsibly managed by enhancing forest planning and certification.
- **Limit the spread of phytosanitary attacks** through active and sustainable forest management, as well as setting up an infrastructural system in line with the operational and safety needs of forests, particularly for fire prevention.
- **Promote the spread of ecosystem services as well as forest tourism,** including welfare and non-timber forest products that can be allocated for food.
- **Through the Forest Valorization Hubs**, it will be possible to disseminate new technologies among local operators, ensure traceability in line with the EU Deforestation Regulation (EUDR) scheme, stimulate the dissemination of safety in forestry sites and provide support for Flagship 1. This includes contributing to the achievement of the National Forestry Strategy and greater valorization of local resources, enhancing the development of the national Bioeconomy.

PROPOSALS FOR OVERCOMING LEGISLATIVE BARRIERS

Despite all the actions put in place and investments in new plants, which are among the most important Bioeconomy innovation projects in Europe, the lack of a clear, consistent and stable legislative framework is discouraging further investment.

To accelerate progress, a stronger connection between integrated Made in Italy platforms, forward-looking financing and strong institutional support is required. These factors should leverage on the new opportunities offered by the advancement of new green technologies, in line with the Italian Bioeconomy Strategy - BIT II, the European Bioeconomy Strategy and the Circular Economy Strategy.

Support for developing a market for products obtained from biobased feedstocks must come through the definition of incentive mechanisms that account for the amount of sustainable raw material used in their production. Existing barriers include: i) the still insufficient dissemination of high-quality standards for chemicals, materials, products and fuels obtained from circular and biobased feedstocks: ii) a lack of measures that allow innovative and sustainable products to compete with existing ones; iii) the absence of measures to valorize the low-carbon effects of biorefinery and biobased industry outputs and their value chain as a whole; iv) the need to measure and valorize the positive effect of biorefineries and the biobased industry in promoting economic circularity and the reduction of environmental impacts (e.g., incentives for activities that contribute to increasing carbon sequestration in soil, such as the production and use of quality compost).

Other obstacles concern the incomplete application of existing legislation and related sanctions, as well as the absence of ATECO-NACE sub-codes for biorefineries and the biobased industry, which does not allow proper recognition of those companies working in the Bioeconomy.

This chapter outlines the main obstacles identified by the public-private actors involved in the Italian Technology Clusters, which hinder the development of a virtuous circular Bioeconomy system, and proposes some actions that can facilitate market access for biobased Bioeconomy products:

1. **Avoid discriminatory legislation to ensure fair competition on domestic and international markets;**

2. **Promote the introduction of Bioeconomy related ATECO/NACE sub-codes and create specific subcategories for the manufacturing of products derived from biomass;**

3. **Recognize the decarbonization** contribution of products, materials, chemicals and energy obtained from biobased feedstocks, as well as from other products sustainably obtained from biological and renewable carbon sources;

4. **Promote a Legislative framework** to encourage the development of efficient organic waste collection systems and the construction of technologically advanced treatment plants, in order to expand the collection and treatment capacity of organic waste;

5. **Promote a Legislative framework** to encourage the production and use of quality compost obtained from the treatment of organic waste and byproducts;

6. **Promote quality standards** and measures to support market demand, starting with compliance with Minimum Environmental Criteria **and the promotion of green public procurement, particularly in waste treatment, recovery and disposal systems,** and products obtained from biobased feedstock;

7. **Develop a legislative framework** that promotes and supports, through fiscal and financial incentives, **products that contribute to the preservation of natural capital resources, including incentives for those contributing to the decarbonization of production processes, materials, chemicals and energy derived from biobased feedstocks, such as bio and biochemical gases, and liquefied gases;**

8. **Promote measures**, including fiscal and financial incentives, for the new construction of efficient District Heating (DH) systems based on the valorization of wood raw material**, including work on extending the network, possibly accompanied by upgrades to power plants (including only the installation of thermal storage).**

These actions should reinforce and implement the existing legislations and strategies (when already in place) and take advantage from case studies that can be directly implemented.

1. Avoid discriminatory legislation to ensure fair competition on domestic and international markets.

Non-tariff barriers to the agri-food sector often arise from the inadequate application/interpretation of the GATT (Uruguay Round) agreements by third countries, particularly the Agreement on Sanitary and Phytosanitary Measures (SPS) and the Agreement on Technical Barriers to Trade (TBT).

These barriers do not decrease in number and importance and are often disguised as health or pseudo-health regulations. In order to prevent and address such problems, the Italian Government must remain vigilant and take prompt action, through diplomatic efforts, in relevant institutional bodies and with third countries.

In addition to the non-tariff barriers resulting from non-compliance with the GATT, the Italian food industry faces various horizontal challenges which restrict the access of Italian products to global markets.

In several third countries, market access for certain Italian products is still denied. This mainly concerns food of animal origin (meat, milk, eggs and their derivatives) but often also extends to foods containing these as ingredients (so-called "compound products" which contain processed animal products and plant-based ingredients, such as ready-made meals, sauces, stuffed pasta, pizzas with cured meats, baked goods, etc.)

There are also challenges related to certification requirements, registration and particularly complex and costly administrative formalities, which severely limit access to third-country markets.

In order to promote fair competition in the food market, while also overcoming the non-tariff barriers (NTBs), it is of paramount importance to adhere to the principle of non-discrimination among sectors or products. This means avoiding legislation that – rather than being grounded on sound scientific evidence – unduly label sectors or products as healthier or more sustainable. These measures would, de facto, fragment the Single Market and create obstacles for Italian and European products in accessing international markets.

This is, for instance, the case with color-coded **Front of Pack Nutrition Labels (FOPNLs)** such as Traffic Lights or Nutri-Score. These schemes offer biased and misleading evaluations to consumers by assessing the individual nutrient or the overall food by using a score or a color, without considering the nutritional contribution of that food or nutrient as part of a balanced diet. Furthermore, such discriminatory and simplistic systems:

- are inconsistent with the wording of Regulation (EU) No. 1169/2011, which clearly advocates for objective and non-discriminatory additional information;
- obstacle the free movement of goods in the Single Market and create unfair competition in international markets, unduly penalizing “a priori” the image of some products over others (this also affects typical Made in Italy excellence);
- create confusion among consumers who may find the same product labelled differently based on different criteria in individual countries.

This is why Italy created a different FOP, the so-called NutrInform Battery, whose underpinning principles should be the basis for any discussion among European and global policymakers on nutrition labelling issues. In fact, NutrInform:

- is voluntary, objective and non-discriminatory (no colors, no alarming messages);
- provides factual information on the individual nutrients contained in a product (ensuring that each consumer can choose according to their particular conditions and state of health);
- is aimed at facilitating consumer’s understanding of the contribution of a food’s energy and nutrient content to their overall diet (instead of dictating consumers what to eat through an obscure algorithm).

Another example of potentially discriminatory rules is the debate around **sustainability labelling**. In this context, it is essential to support the goal of developing harmonized legislation on certain aspects, such as green claims (currently under review by EU legislators), in order to set a series of minimum requirements for the voluntary provision of environmental information about products. At the same time, it is equally important to avoid any kind of environmental accounting based on algorithms with weak or questionable scientific foundations, or environmental labeling systems aimed at assessing the environmental sustainability of individual food items based arbitrarily on only a few parameters included in the calculation algorithm. In fact, as with the FOPNLs debate, the use of traffic light systems and, in general, of directive labeling systems, should be rejected. These systems solely direct consumer choices – rather than providing information necessary for free and informed decision-making – and create imbalances in the market. As a general rule, green claims should work as a lever for companies to improve their environmental performances by showing the efforts made to become more environmentally friendly, and not as a punitive tool to judge one company's performance over another's. Moreover, any potential sustainability label (which encompasses more than just the environmental aspect) must equally consider all three pillars of sustainability: environmental, social and economic. Only this way can fair competition within the food system be properly ensured.

2. Promote the introduction of Bioeconomy related ATECO/NACE sub-codes and create specific subcategories for the manufacturing of products derived from biomass.

Bioeconomy activities should be represented in the NACE/ATECO codification, as they are currently identified through the same codes as traditional sectors.

In order to promote these activities and boost the demand for products deriving from biomass, it is essential to formally recognize the biobased sector by creating dedicated NACE/ATECO sub-codes.

The peculiarities and requirements of a sector that uses renewable resources to produce solutions addressing environmental issues need to be distinguished and made clearly identifiable.

The identification of such sub-codes should also provide simplified methods for the recognition of Bioeconomy products at customs offices.

For example, the following codes are proposed:

20.14.02. Manufacture of basic chemical products derived from biomass,

20.16.01. Manufacture of plastics derived from biomass,

20.20.01. Manufacture of agrochemicals and other agricultural chemical products derived from biomass,

20.54. Manufacture of hydraulic fluids, greases, transmission fluids and dielectric fluids derived from biomass,

22.22.01. Manufacture of plastic packaging derived from biomass.

The absence of these codes is, on the one hand, a limitation to the recognition of the environmental and social value of Bioeconomy products and, on the other hand, it prevents an appropriate valorization of this sector within the framework of EU Commission policies.

This is not just a statistical issue: the ATECO sub-codes are also fundamental in terms of fiscal and administrative actions (as exemplified by the INDUSTRA 4.0 criteria, which exclude certain

ATECO codes from support measures). For this reason, it is essential to work on the ATECO sub-codes (rather than PRODCOMs or similar instruments), in order to propose specific exceptions within the framework of national support measures for the valorization of the Bioeconomy, in line with the objectives of the National Strategy for the Bioeconomy).

3. Recognize the decarbonization contribution of products, materials, chemicals and energy obtained from biobased feedstocks, as well as from other products sustainably obtained from biological and renewable carbon sources.

In order to promote the market for products obtained from biobased feedstock, it is essential to implement legislation aimed at encouraging the use of renewable raw materials and valorizing the decarbonization benefits provided by these products.
This should be translated in legislative acts aimed at providing incentives for biobased products and/or mandatory biobased content requirements, with increasing targets over time.
Another important issue is related to the recognition of the contribution to decarbonization provided by companies that produce products obtained from biobased feedstocks.

4. Promote a Legislative framework to encourage the development of efficient organic waste collection systems and the construction of technologically advanced treatment plants, in order to expand the collection and treatment capacity of organic waste.

Regarding the transposition of the European Directive related to the Circular Economy Package, the following priorities and needs are identified in the area of organic waste:
- To enable bio-waste to be used as a source of high-quality fertilizer and soil improver, it must be collected separately at source, while minimizing impurity levels. Implementing a separate bio-waste collection system is essential for obtaining high quality outputs.
- Organic waste plays a key role in meeting national recycling targets for municipal and packaging waste, provided it fulfils the criteria of biodegradability and compostability (and is therefore subjected to composting and/or anaerobic digestion operations).[43]
- To strengthen the action of the Observatory for the Circular Economy of the Ministry of the Environment and Energy Security, which provides specific actions for the management of the organic waste fraction (material and energy recovery).
- Promote collaboration between the national government, regional and local authorities, as well as public and private subjects involved in research and the promotion of new partnerships necessary to address the identified needs, in line with the National Waste Management Program[44], approved under Article 198-bis of Legislative Decree 152/2006.

[43] As required by the European Delegation Law 2018 n. 117 of 4/10/2019 (art. 16 letter h) it is necessary "to calculate the relative organic recycling in the national recycling targets for municipal waste and packaging waste".

[44] https://www.mase.gov.it/pagina/programma-nazionale-la-gestione-dei-rifiuti.

5. Promote a Legislative framework to encourages the production and use of quality compost obtained from the treatment of organic waste and byproducts.

The production and use of quality compost, obtained from the treatment of organic waste, agricultural residues and wastewater sludge, allow the return of organic matter to the soil, providing a concrete way to improve soil quality and prevent its degradation. To achieve this goal, the following indications , outlined in the National Waste Management Program, could be adopted:

- Optimize the separate collection of the organic waste fraction and the quality of the fraction collected;
- Define the residual plant requirements to maximize regional self-sufficiency;
- Construction and/or modernization of integrated anaerobic digestion systems/plants, especially in poorly equipped areas for an advanced organic waste treatment, enabling the production of quality soil improvers and the valorization of biomethane;
- Support the use of compost produced by integrated systems that valorize both organic waste fraction and sludges.

6. Promote quality standards and measures to support market demand, starting with compliance with Minimum Environmental Criteria and the promotion of green public procurement, particularly in waste treatment, recovery and disposal systems, and products obtained from biobased feedstocks.

The **Minimum Environmental Criteria (CAM)** are the environmental requirements defined for the different stages of the Green Public Procurement process, aimed at identifying the best environmentally sustainable solution, product or service from throughout its life cycle, taking into account market availability.

In Italy, the effectiveness of CAM has been ensured thanks to a legislative act[45] which mandates all contracting stations to apply these criteria. This obligation ensures that the national policy on green public procurement is incisive, not only in the objective of reducing environmental impacts but also in promoting more sustainable, "circular" production and consumption models and in creating "green" jobs, as well as implementing the DNSH principle ("*Do No Significant Harm*", Taxonomy regulation 852/2020).

Greater support for the application of these criteria by municipalities would be desirable, particularly through the definition of less restrictive and clearer requirements, as well as increased training for administrative officers overseeing purchasing procedures, especially in small-sized municipalities.

In this context, it would also be important to adopt specific decrees to boost public demand for biobased products and energy, from bio-based feedstocks providing benefits in terms of sustainability according to recognized standards, such as new CAM to promote the uptake of sustainable biofuels to be used in pure form in public transport.

[45] Art. 18 of Law 221/2015 and, subsequently, art. 34 containing "Energy and environmental sustainability criteria" of Legislative Decree 50/2016 "Procurement Code" (modified by Legislative Decree 56/2017).

7. Develop a legislative framework that promotes and supports, through fiscal and financial incentives, products that contribute to the preservation of natural capital resources, including incentives for those contributing to the decarbonization of production processes, materials, chemicals and energy derived from biobased feedstocks, such as bio and biochemical gases, and liquefied gases.

Some categories of Bioeconomy products are specifically designed to protect soil from pollution and contamination.

To fully implement the European Green Deal and the European Industrial Strategy, and to accelerate the transition to a circular economy model, the ESPR (Ecodesign for Sustainable Products Regulation), Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024, establishing a framework for setting eco-design requirements for sustainable products, amending Directive (EU) 2020/1828 and Regulation (EU) 2023/1542, and repealing Directive 2009/125/EC), has been adopted. This Regulation will establish a framework to make the eco-design approach initially set out in Directive 2009/125/EC[46] of the European Parliament and of the Council applicable to the broadest possible range of products. The main objectives of this regulation aim at reducing the negative lifecycle environmental impacts of products and improve the functioning of the internal market.

This Regulation also contributes to the objectives of EU industrial policy to boost both the supply of and demand for sustainable goods, promoting sustainable production and ensuring a level playing field for products sold on the internal market.

Thereby, this proposal aims to provide harmonized requirements applicable across the board, efficient means of compliance, proper enforcement, reinforced market surveillance and customs controls.

By applying the eco-design approach to a wide range of products and enabling it to set comprehensive product requirements, this regulation seeks to address the most detrimental environmental impacts of products.

It therefore lays down a framework for setting eco-design requirements based on the sustainability and circularity aspects outlined in the Circular Economy Action Plan, such as product durability, reusability, upgradability and reparability, the presence of substances of concern, product energy and resource efficiency, recycled content, product remanufacturing and high-quality recycling and the reduction of products' carbon and environmental footprints. Although the direction set out by the approving regulation, with the gradual introduction of eco-design requirements, supports the achievement of the objectives set at the EU level, there is still room for improvement in the regulatory framework, as well as in many aspects of the regulations which could be more clearly defined in order to achieve more ambitious targets.

In line with the European Green Deal and the European Industrial Strategy (and the related policies and legislative acts[47]), the use of Bioeconomy products can contribute to the adoption of more sustainable practices.

For this reason, it is essential to promote and support, also through national policy actions, the use of sustainable products obtained from biomass, particularly those specifically designed

[46] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.

[47] i.e. the proposed European Regulation on Eco-design and the European communication on "Building the future with nature: Boosting Biotechnology and Biomanufacturing in the EU".

to protect soil from pollution and contamination and to reduce the carbon footprint related to human activities.

As an example:

- Biolubricants should be promoted as an optimal solution for all machinery operating in ecologically sensitive areas, such as agricultural, forest, wetland, marine or urban areas, since, in the event of accidental dispersion in the environment they biodegrade within a few days without leaving any trace.
- Given the issues of desertification and pollution affecting our soils, the use of products obtained from biomass that do not accumulate in the soil and protect it in case of accidental release should be promoted and supported through policy actions. Examples include bioherbicides, biodegradable agricultural plastics (i.e. mulching films, clips, trays, slow-release fertilizers, etc.) or products in contact with organic material (i.e. food service ware, food packaging, bags, etc.) that, if compostable, do not contaminate compost. In this sense it will be crucial to promote compostable bioplastics within the implementation of the Packaging and Packaging Waste Regulation, by exploiting all the opportunities provided by article 9.

Moreover, in line with the ambitious decarbonization goals, it is essential to promote sustainable alternatives also in the energy sector, by supporting the use of biofuels and biomethane.

8. Promote measures, including fiscal and financial incentives, for the construction of efficient District Heating (DH) systems based on the valorization of wood raw materials, including work on extending the network, possibly accompanied by upgrades to power plant (including only the installation of thermal storage).

Promote measures, including fiscal and financial incentives, for the construction of new, efficient District Heating (DH) systems based on the valorization of wood raw material, including efforts to extend the network, possibly accompanied by upgrades to the power plant (e.g., only installation of thermal storage). Additionally, this includes the construction of a new power plant and the modernization of existing ones, involving all necessary interventions to improve efficiency of underperforming DH systems.

MEASURES TO MAXIMIZE ACTIONS' IMPACTS

Action Plan Communication and Dissemination

This IAP will be presented at a dedicated event hosted by the Presidency of the Council of Ministers in the second semester of 2024. The event will be open to any national and international stakeholder interested in engaging with the implementation process.

Subsequently, The National Bioeconomy Coordination Board will hold an annual public forum in order to stimulate participation from research, industrial, primary producers, education and citizen communities, allowing them to share their needs and contribute to the improvement and efficient implementation of the proposed actions.

Action Plan Monitoring and Controlling

Coordination and monitoring of the actions outlined in this IAP will be carried out in accordance with the criteria and indicators discussed for the BIT II strategy, under responsibility of the National Bioeconomy Coordination Board (NBCB) of the Presidency of the Council of Ministers.

Close collaboration with the EC Knowledge Centre for Bioeconomy and the *Joint Research Centre* of the European Commission will allow the consistent updating of indicators and monitoring practices, ensuring alignment with the EU's common Bioeconomy monitoring system.

The actions, recommendations and overall action plan focus on addressing the identified strategic actions, while aligning actors, territories, and value chains.

To ensure the effective achievement of the strategic objectives outlined in this IAP, the NBCB will review the implementation actions in progress on an annual basis, also adapting or discontinuing activities that do not contribute satisfactorily to the IAP'S objectives, based on a thorough analysis conducted with the participation of NBCB members.

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