

IMPLEMENTATION ACTION PLAN (2020-2025) FOR THE ITALIAN BIOECONOMY STRATEGY BIT II



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EXECUTIVE SUMMARY

The present Implementation Action Plan (IAP), after presenting the national context with particular reference to the role of Bioeconomy in Italy, in coherence with the recently revised national Bioeconomy Strategy (BITII), describes:

- how the circular Bioeconomy can boost the socio-economic recovery in this particular critical period and its key role in the post-COVID 19 phase;
- a detailed action plan 2020-2025 including a series of relevant targeted actions which have been clustered into 4 main macro areas (policy/standards, pilot actions, regeneration of ecosystem services, and stakeholder's engagement);
- flagship projects ready for deployment at national level, to provide concrete examples of how circular Bioeconomy investment can act as catalyst of socio-economic post-COVID 19 restarting;
- legislation needs and economic opportunities;
- a plan for dissemination and monitoring of IAP results and impacts.

The global pandemic has revealed the worldwide fragilities of the current model of production and consumption, pushing to follow sustainable approaches considering the necessity to integrate social, economic and environmental perspectives.

The Bioeconomy proposes to reach a new equilibrium between all these dimensions, considering its huge economic potential preserving natural capital and its intrinsic ability to quickly adapt and rethink the production logic, while ensuring production stability and the health and safety of communities, essential to overcome the emergency. Thus, Circular Bioeconomy, as part of the Circular Economy, can represent a valuable mean to boost the post covid 19 recovery and sustainable resumption, rooted on a decarbonized resilient economy.

However, the potential of Bioeconomy will fully manifest its impact on the Italian socio-economic system if the public-private partnerships sustaining it will be strengthened and the following actions implemented:

- promote the development and adoption of a clear, stable regulatory framework,;
- develop investments at local level to support the national rural and urban Circular Bioeconomy in all the sectors;
- implement circular and regenerative approaches aimed at protecting and restoring damaged ecosystems and biodiversity loss
- promote the integration between sectors both vertically (supply chain) and horizontally (territory), the active involvement of primary producers and citizens, the improvement of skills, education, training and entrepreneurship.

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To facilitate the implementation of priorities identified in BIT II, through the assets of the circular Bioeconomy mentioned above, operational actions under four broad line of actions have been identified. They are:

- 1) Promoting the development/adoption of policies, standards, labels and emerging market-based actions and incentives;
- 2) Launching pilot actions at the local level to support the national circular Bioeconomy in the domains of agrifood, bio-based, forestry, and marine and maritime sectors, in rural, coastal and urban areas;
- 3) Enhancing the knowledge, protection and restoration of national biodiversity and ecosystems, and ecosystem services on their resilience/adaptation to climate changes;
- 4) Promoting awareness, skill upgrading, education, attitude, training, and entrepreneurship across the Bioeconomy.

Moreover, the IAP proposes a number of ready, concrete and replicable national projects, e.g. flagship investments emerged through the consultation of the core stakeholders of the National Technology Clusters on agrifood, bio-based industry and blue growth; they are:

Flagship 1 – creation of new regional value chains interconnecting rural or marginal lands with multi-inputs and multi-products biorefineries;

Flagship 2 – urban biowaste and wastewater/sludges integrated valorisation with the production of compost, biochar, biomethane, chemical substances and materials for the benefit of the territory;

Flagship 3 – reconversion of former oil refineries and industrial sites in crisis through the Bioeconomy;

Flagship 4 – restoration of the marine ecosystem and improvement of sustainability of the fishery value chain in the Adriatic-Ionian macro region;

Flagship 5 – circularity in the Italian meat and wine agri-food chains.

Finally, IAP includes an analysis of some proposals for overcoming legislative barriers as necessary prerequisite to support the development of Bioeconomy initiatives in the country, related to definition of End of waste regulatory process, directives and measures related to single use plastics, regulations designed to promote the development of efficient systems for the collection of organic waste and to encourage the production and use of quality compost, quality standards and measures to support market demand, development of a legislative framework promoting eco-design and supporting those products that are designed to reduce pollution and contamination of soils.

INTRODUCTION

THE GLOBAL PANDEMIC HAS REVEALED THE WORLDWIDE FRAGILITIES OF THE CURRENT MODEL OF PRODUCTION AND CONSUMPTION, based on dissipation of natural resources, relocation of production, disconnection with territories and communities. It is now necessary to abandon a development approach based on the realization of short-range objectives and an idea of unlimited growth to the detriment of the quality of life and of the natural and social capital of communities in the context of growing environmental impact.

BIOECONOMY IS ONE OF THE KEY PILLARS OF THE ITALIAN ECONOMY, and, with an annual turnover of 345 billion euros and 2 million employees, the Italian Bioeconomy is the third in Europe after Germany and France. Italy owns a long-lasting experience of Circular Bioeconomy, as part of the circular economy that uses biological resources, from land and sea, as the input for the production of food and animal feed, and different industrial goods such as, among others, materials and energy. Because of the synergy between primary production and industry, the Bioeconomy can effectively contribute to revitalize territories starting from quality and low impact agriculture and by leveraging on relational capital of rural communities. The virtuous collaboration and partnerships among stakeholders of the public, private and civil society translates into projects able to valorize natural resources while respecting ecosystems and local communities. To better unleash the potential of the Italian Bioeconomy, the Prime Minister's Office (Renzi and Gentiloni' governments) promoted in 2016 and 2017 the establishment of a national Bioeconomy strategy (BIT) and, more recently (2019, 1st Conte's Government), its update (BIT II). The document aims to a more effective integration of main sectors of the national Bioeconomy and to facilitate the cooperation between the country's ministries, regions and autonomous provinces in terms of alignment of policies and regulations, R&I funding programs, development of infrastructure, etc. This strategy, drafted and currently implemented by a National Bioeconomy Coordination Board, activated within the Presidency of Council of Ministers, aims to achieve a 15% increase in the current turnover and employment of the Italian Bioeconomy by 2030.

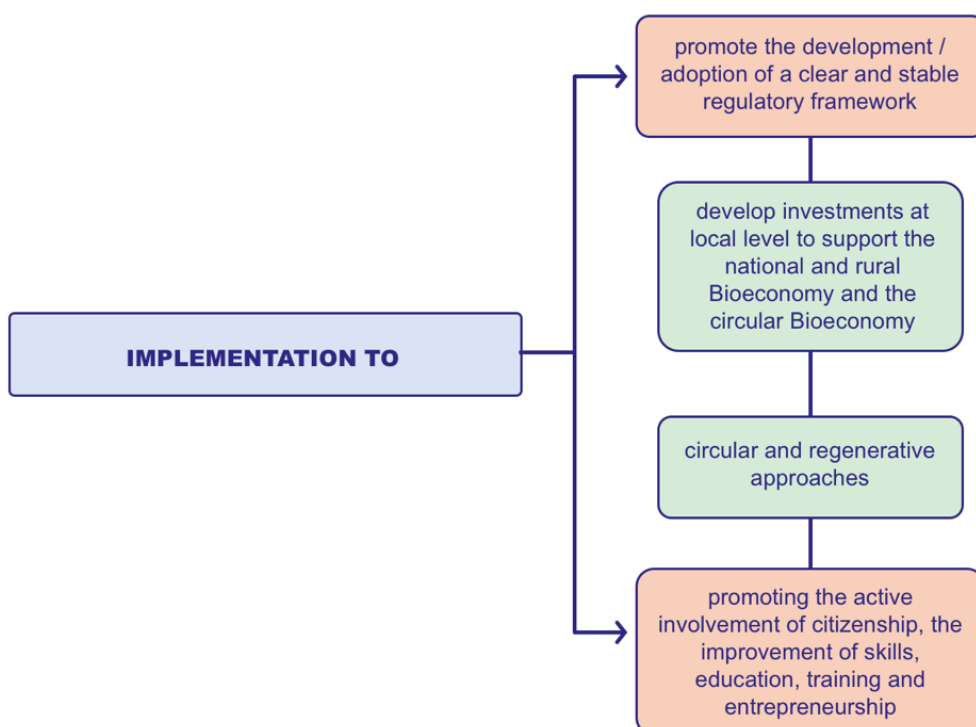
ALTHOUGH IMPACTED BY HEALTH EMERGENCY FOR COVID19, THE CIRCULAR BIOECONOMY MODEL HAS SHOWED TO BE RESILIENT because of its intrinsic ability to quickly adapt and rethink the production logic, while ensuring production stability and the health and safety of communities.

The present context revealed the fragility of the current linear business models and their inadequacy to tackle present and future challenges. It is evident that a mere return to a "business as usual" regime would be inconsequential. **CIRCULAR BIOECONOMY CAN REPRESENT A VALUABLE MEAN TO BOOST THE POST COVID 19 RECOVERY AND SUSTAINABLE RESUMPTION**, rooted on a decarbonised resilient economy. The Bioeconomy delivers solutions for mitigating and preventing ecosystems degradations, creating new jobs and business opportunities also for small and medium-sized enterprises, and innovative start-ups in an *Open Innovation* logic. Indeed, the perceived value of the different assets of the circular Bioeconomy model has increased in this critical period, thanks to their role as essential foundation of health and socio-economic well-being and prosperity of our communities. Starting from the sustainable value chains for the production of food and feed and moving across the innovative biobased products that nourish the excellence of the manufacturing

sectors of Made in Italy, the Bioeconomy implements tangible economic value and quality in the territories, respecting ecosystems and preserving biodiversity.

The potential of Bioeconomy will fully manifest its impact on the Italian socio-economic system if the public-private partnerships will be strengthened and the IMPLEMENTATION OF A SERIES OF ACTIONS will be adopted with regard to:

- **promoting the development and adoption of a clear, stable regulatory framework**, rooted in adequate policies, supported by high quality standards and measures that allow innovative and sustainable products to compete with conventional ones and to increase market penetration;
- **developing investments at local level to support the national rural and urban Circular Bioeconomy** in all the sectors, including agri-food, biotech and bio-based industry, forestry, marine and maritime sectors;
- implementing **circular and regenerative approaches** aimed at protecting ecosystems, reducing risks for biodiversity, and bringing clean organic matter back to the soil, closing the carbon cycle;
- **promoting the integration between sectors both vertically (supply chain) and horizontally (territory), the active involvement of primary producers and citizens, the improvement of skills, education, training and entrepreneurship** throughout the Bioeconomy sectors.



READY, CONCRETE AND REPLICABLE NATIONAL PROJECTS HAVE EMERGED (as part of the consultation with national stakeholders of the National Technology Clusters joining the National Bioeconomy Coordination Board); they will contribute significantly to the new economic recovery of the country after the health emergency, if properly catalysed and supported by public-private investments. These **projects identified so far** are aimed at:

- **the adaptation and development of infrastructures for the recovery and treatment of organic matter** and other fundamental nutrients in the liquid and solid flows of **organic waste, urban and industrial wastewater and sludge**;
- **the creation of territorial value chains interconnected with national multi-input and multi-product biorefineries** capable of transforming waste and co-products destined to become waste, as well as biomass from marginal soils, into sustainable products designed to not pollute the liquid and solid carbon flows;
- **the reconversion of industrial sites in crisis in synergy with the agricultural sector**;
- **the regeneration of the Adriatic-Ionian marine macro-region with its decontamination** from plastic, waste and war residues;
- **the sustainable reinforcement of the associate fisheries and aquaculture value chains**;
- **the integrated and multipurpose valorization of by-products and waste of the Italian meat and wine value chains** with the production of food ingredients and high added value products along with biofuels and (bio)fertilizers

Finally, it is important to underline the necessity of overcoming the **EXISTING BARRIERS FOR A FULL DEVELOPMENT OF THE CIRCULAR BIOECONOMY SECTORS**. Despite all the actions put in place and the relevant investments in new plants and projects, which are among the most important in Europe, there is still no clear regulatory framework capable of leveraging on our national strengths in terms of innovation and high-quality standards. Both at European and national level, one of the main obstacles to the development of the Circular Economy is the lack of a clear and stable legislative framework, essential element to encourage investments. Measures are required to disclose environmental costs and externalities of conventional existing products that do not meet sustainability targets. Conversely, incentives for activities will promote the circularity of the economy and the reduction of environmental impacts, especially with regard for those that contribute to the restoration of carbon in the soil, such as the production and use of quality compost, and of all other ecosystem services. Other obstacles concern the incomplete application of laws already in force and related sanctions and the lack of homogeneity of the authorization approach regarding End of Waste due to the discretion of the various local legislations.

The development of new flagship investments, in synergy with the overcoming of regulatory bottlenecks, will enable the best forces of the Country to be deployed and to bring out a generative, competitive, and sustainable creativity. This distinctive element will make Italy an exemplary model - at EU and global level - of resilient development, which integrates the economic, social and environmental dimensions, regenerates territories, creates new quality jobs, leveraging on skills, education and infrastructures.

SCOPE OF THE IMPLEMENTATION ACTION PLAN

The global pandemic has worldwide revealed the fragilities of the current production and consumption model, based on dissipation of natural resources, relocation of production, disconnection with territories and communities. It is necessary to abandon definitively a development approach based on short-range objectives and on an unlimited growth vision detrimental for the quality of life and the community natural and social capital in a context of growing environmental impact.

The Bioeconomy is one of the core pillars of the Italian economy, with about 11% of the country turnover and employment. The Italian Bioeconomy Strategy defines the circular Bioeconomy as that part of the circular economy that uses biological resources, from land and sea, as the input for the production of food and animal feed, and different industrial goods as materials and energy, among others. Despite the health emergency associated with Covid19, the circular Bioeconomy sectors are proving to be resilient and they represent a consolidated and robust asset for accelerating the post Covid 19 restart in our Country.

The National Bioeconomy Coordination Board (NBCB) of the Presidency of Council of Ministers (active in the frame of the National Committee Biosafety, Biotechnology and Life Sciences of the same Presidency¹, involving representatives of five Ministries and of all Regions and Autonomous Provinces, National Agency for Territorial Cohesion, SVIMEZ, and the main relevant National Technology Clusters - public private partnerships -, who developed BIT II²), prepared this Implementation Action Plan (IAP). **The IAP has the objective to translate emerging BIT II priorities into well identified actions and related monitoring system, in order to ensure an operational roll-out of the Italian Bioeconomy potential across Italy in the next 5 years.** It is consistent with the other national strategies relating to the production of bioresources, their mobilization and use within the ecological limits. **The NBCB will facilitate the implementation of the IAP actions and yearly monitor the IAP adoption processes.** NBCB 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 and associated initiatives. This cooperation will facilitate the exchange of best implementation actions and practices, enhance inter-country cooperation and joint activities, promote the overall implementation of the Bioeconomy strategies in all EU Countries and the shaping of a concrete agenda of joint actions and recommendations, aiming at strengthening the development of the Bioeconomy in the EU as a whole. The IAP aims also to facilitate the alignment of the Italian Bioeconomy priorities and actions with the Water framework Directive, the Marine Strategy Directive, the “Biodiversity” and “Farm to Fork” Strategies, the new Circular Economy Action Plan “For a cleaner and more competitive Europe”, all part of the EU Green Deal, and the ones related to the forest and the marine and maritime sectors, as well as with the opportunities foreseen in the frame of CAP and Horizon Europe, especially via its Cluster 6 “Food, Bioeconomy, Natural Resources, Agriculture and Environment”, and its related Missions and Partnerships.

¹ <http://cnbbsv.palazzochigi.it/en/areas-of-work/bioeconomy/>

² http://cnbbsv.palazzochigi.it/media/1774/bit_en_2019_02.pdf

THE NATIONAL CONTEXT: THE ROLE OF BIOECONOMY IN ITALY IN COHERENCE WITH THE BITII STRATEGY

The Bioeconomy encompasses the whole range of activities ranging from the terrestrial and marine bioresource production to their processing and the use of products obtained. The objectives of the Bioeconomy Strategy consist of providing an environmental, social and economic sustainable response to the need for food and bio-based materials and energy, while at the same time preserving and restoring natural resources via a sustainable management of water, soil, biodiversity, and guaranteeing the provision of high-quality environmental services. **Bioeconomy has also a fundamental role in the decarbonization of systems and the regeneration of ecosystems and of territories, starting from the centrality of soil health. It can be an effective accelerator for sustainable innovation, regenerating natural resources, marginal/desertified/abandoned as well as marine and coastal areas, and transforming peripheral areas into strategic centers, a driving force of competitiveness for Italy and for the EU.**

Bioeconomy is one of the crucial and enabling pillars of Italian economy. With EUR 345 billions of annual turnover and 2 millions of employees (2018 data), it is the third Bioeconomy in Europe; the Country is often second in terms of presence in the R&I projects funded by Horizon 2020 Societal Challenges 2 and BBI JU and the first one in terms of quality products in the food and bio-based product domains. The Circular Bioeconomy contributes to the reduction of the Country dependence from fossil fuels and finite materials, biodiversity losses and land use changes; furthermore, it **contributes to the environmental regeneration and the creation of new economic growth and jobs in the rural, coastal and former industrial areas**, leveraging on regional specificities and traditions.

To further exploit the whole Bioeconomy potential, **the Italian Government promoted the setup of a national Bioeconomy Strategy in 2017 (BIT) and, more recently, its update (“A new Bioeconomy strategy for a sustainable Italy”, BIT II, 2019³).** The BIT II aims to interconnect more efficiently the main economic sectors composing the Italian Bioeconomy, namely the production of renewable biological resources and their conversion into valuable food, feed, bio-based products, wooden products, and bioenergy, along with the transformation and valorization of bio-waste streams. **Moreover, BIT II aims to a better governance model through increased coordination of Ministries, Regions and autonomous Provinces and the alignment of policies, regulations, R&I funding programs and investments in infrastructures.** The overall goal is a 15% increase of the current turnover and jobs of the Italian Bioeconomy by 2030 by implementing priority actions and an R&I agenda, which are accompanied by measures creating and guaranteeing the framework conditions. Due to the strategic geo-political role of Italy in the Mediterranean basin, BIT II also includes actions to improve sustainable productivity, social cohesion, and greater political stability through the implementation of **Bioeconomy in the Mediterranean area**, in line with the PRIMA partnership, and the BLUEMED and WESTMED initiatives. BIT II vision is well aligned with the European Union regulatory effort which has focused its intervention on climate change, energy, agriculture, forestry and marine, aquaculture and fishery sectors along with a **strong focus on the**

³ http://cnbbsv.palazzochigi.it/media/1774/bit_en_2019_02.pdf

efficient use of natural resources, circularity and waste management. This reflects well in national legislative initiatives, as well as in the ongoing effort to support sustainability standards for prompting the market uptake of bio-based products.

THE CIRCULAR BIOECONOMY TO SUPPORT THE POST COVID-19 PHASE

The Bioeconomy is one of the pillars of the Italian Economy and, though impacted by health emergency for covid19, it showed to be resilient, being deeply rooted in the territories and able to enhance their intrinsic adaptive and community spirit, rethinking production logics in a timely manner, ensuring production stability while giving absolute priority to the health and safety of people, and leveraging on a spirit of solidarity along the entire supply chain.

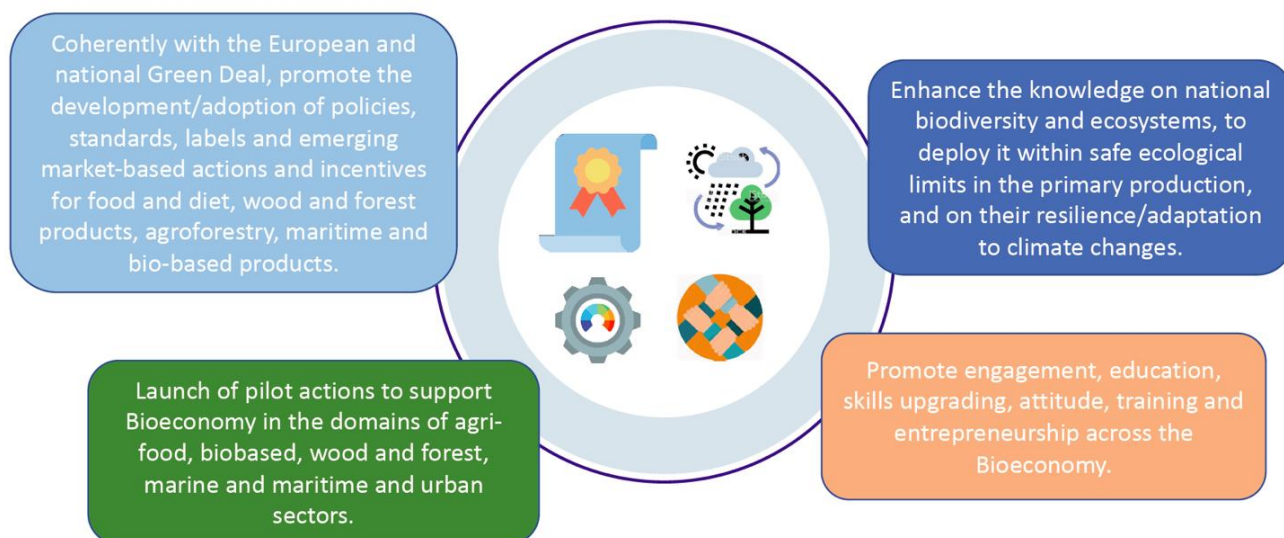
The circular Bioeconomy supply chains produce high quality and nutritional food for all, as well as essential materials, clean water and energy in a sustainable way. At the same time, it is able to regenerate forest, rural, coastal and industrial disused areas, and thus local biodiversity and ecosystems, creating local new jobs and establishing wide ecosystem conditions for the prevention and containment of future zoonoses and epidemics. The products of the circular Bioeconomy are also **feeding several of the core manufacturing sectors of the “Made in Italy”, contributing to create new competitiveness. The Italian Bioeconomy is a driving force for innovation, regeneration and sustainable growth, and therefore for the social cohesion and political stability, of the entire Mediterranean Basin.**



THE BIT II IMPLEMENTATION ACTION PLAN 2020-2025

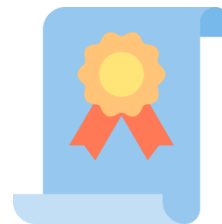
To facilitate the implementation of priorities identified in BIT II, through the assets of the circular Bioeconomy mentioned above, operational actions under four broad headings have been identified. They are:

- 1) **Promoting the development/adoption of policies, standards, labels and emerging market-based actions and incentives;**
- 2) **Launching pilot actions at the local level to support the national circular Bioeconomy in the domains of agrifood, bio-based, forestry, and marine and maritime sectors, in rural, coastal and urban areas;**
- 3) Enhancing the **knowledge, protection and restoration of national biodiversity** and ecosystems, and **ecosystem services** on their resilience/adaptation to climate changes;
- 4) Promoting **awareness, skill upgrading, education, attitude, training, and entrepreneurship** across the Bioeconomy.



ACTION 1

Coherently with the European and the national Green Deal and the related European strategies and instruments launched by the European Commission, promote the development/adoption of policies, standards, labels and emerging market-based actions and incentives for sustainable food production and healthy diets, forest maintenance and production of forest goods and services, maritime and bio-based products, on the basis of reliable scientific-based data on environmental and climate performance and socio-economic and environmental impacts.



The recommended actions are:

- **Embed the Bioeconomy strategy into law framework to guarantee its recognition and application**, according to a biannual implementation plan;
- **Deploy the post-2020 CAP National Strategic Plan** to enhance increased sustainable production and use of biomass and the development of innovative Bioeconomy sectors embedded in locally rooted supply chains through specific measures devoted to:
 - a) improving the position of farmers in the bioeconomy supply chain also by promoting innovative short biobased supply chains;
 - b) promote reduction of the use of chemical substances in the primary production and boost sustainable organic farming contributing to the European Green Deal and Farm to Fork objectives and to soil restoration;
 - c) adopting low emission feeding strategies and improving manure management in order to enhance the sustainability of the livestock sector;
 - d) fostering climate change adaptation and resilience by sustainable management of agricultural and forest and marine areas, promoting agroforestry, reducing soil erosion and hydrogeological risks, achieving a more sustainable water management and food security;
 - e) contributing to the achievement of the EU Green Deal target on antimicrobials by reducing their high use in terrestrial and aquatic livestock farming;
 - f) stronger encouraging young and women to move into farming and other activities in rural, coastal and marine areas;
 - g) protect and maintain both traditional crop varieties and animal breeds, which are linked to traditional farming systems and combat invasive species that are threatening our biodiversity;
 - h) support the reduction of food waste along the entire supply chain, with incentives at the level of consumers and differentiated charges at the level of retail and production and supply chains; .
 - i) Higher attention to sustainable food packaging and increased shelf life.
- Promote the adoption of standards, labels, market-based actions and incentives in support of the **transition towards sustainable seafood production** and value chain in line with the

objectives of Farm to Fork strategy, Common Fisheries Policy, and Blue Growth initiatives enhancing the climate and environmental performance of the marine primary sector.

- Unfold Italian huge potential to balance C fluxes in resilient and productive sustainably managed forests, through the resource-efficient use of the renewable raw materials they deliver, as well by increasing the development of innovative forest products, including bio-based chemicals and construction & building materials);
- **Strengthen standard and label for low impact bio based products** to improve public perception and market acceptance of biobased products, **developing country-based Life Cycle Inventories and other tools**, including carbon accounting, based on which promoting **those biobased products which provide evidence on the contribution to lower GHG emissions assessed via LCA procedures** in a wide range of sectors (among all, agriculture, aquaculture, SMEs, domestic sector, etc.);
- **Issue a decree, which fosters systematic use of bio-based products** by official departments and agencies and in **public-sector organizations, hospitals and schools through Green Public Procurements**;
- Re-examine fossil fuel subsidies and **strengthen environmental subsidies for low impact biobased products**, thus creating a level playing field for bio-based industries;
- **Promote the use of products, including the biobased recyclable ones, able to biodegrade in different environments in applications** where there is a risk of an accumulation of non-biodegradable residues in liquid and solid carbon streams and in soils, with effects also on water quality;
- **Promote use of biobased H₂**, both from steam-reforming of biomethane and from steam-gasification of lignocelluloses biomass;
- **Support waste prevention and sustainable waste management actions**, through waste hierarchy, incentivizing separate collection, subsidizing recycling and reuse, and discouraging landfill disposal;
- **Promote the use of compost, digestate and high-quality organic materials in agriculture**, to tackle the desertification issue and reducing organic material ending up in landfills;
- **Encourage investors towards provision of finances in the Bioeconomy sectors** (e.g. banks, “business angels”, insurers, pension funds, investment funds, crowdfunding schemes), by increasing the awareness on the contribution of Bioeconomy to economic development, mitigation of climate change and environment preservation;
- **Promote a capillary digital innovation and transformation of sectors, with new business models reproducible and adaptable to different social and geographical contexts**, by leveraging on local actors and territorial resources, also paying attention to solutions requesting low technological and financial input. An example can be represented by the development of collective and more efficient irrigation systems, able to maximize the effects and lowering the losses of the irrigation;

- **Promote Bioeconomy priorities and actions in the frame of national and regional S3**, not only by mobilizing structural funds at regional level, **but also promoting an inter-regional implementation of Bioeconomy** through cooperation and coordination, as well as **stimulating synergy among different public and private funding sources for lowering the risk for investments in Bioeconomy initiatives** (such as Circular Bioeconomy Thematic Investment Platform, established by the European Commission, the Common Agricultural Policy (post-reform), the InvestEU Programme, the future European Innovation Council and the ETS Innovation Fund);
- **Promote Bioeconomy priorities and actions in the frame of national and regional ERDF Operational Programmes, in the context** of support for research and innovation initiatives related to the specific objectives of **Policy Objective 1 (A smarter Europe)** and of initiatives aimed at promoting clean and fair energy transition, green and blue investment, 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)**.

ACTION 2

Launch of pilot actions to support circular Bioeconomy in the domains of agri-food, biobased, wood and forest, marine and maritime and urban sectors



1.1.0 Rural Bioeconomy

In Italy, the priority is to deploy the Bioeconomy in the territories, valorizing the local traditions and biodiversity, trying to make their economies more dynamic. Regarding to rural area, small-to-medium bio-based solutions are recommended, along with the identification of technologies that are suitable to operate at small scale and easy to replicate and/or to adapt to local conditions and promote demonstration activities. Quite relevant to that objective are "living labs" where place-based, multidisciplinary, multi-stakeholders and ecological-based innovations are developed and tested. They promote concrete and efficient ways of cooperation and sharing of experiences between different players such as farmers, forest owners, advisors, researchers, businesses, policymakers, citizens. The following sub-actions are proposed:

- **Develop and test “living labs” as place-based, local infrastructures where multiple disciplines and stakeholders can exchange ideas, co-create, test and replicate** agri-food, forestry, marine-based products, bio based and sea-based **Bioeconomy solutions** on different scales (e.g. from pilot to landscape);
- **Promote the transition of agriculture, livestock husbandry, and aquaculture to climate neutrality, reducing the negative environmental impact of the food activity, to exploit a) low input crops in marginal lands by improving the soil organic matter content and fertility b) low energy and low impact aquaculture systems and low fishery pressure, and to promote monitor seawater and sediment quality;**
- **Support and encourage sustainable forest management** and a resource-efficient biomass use, according to the “cascade use” approach of wood products;
- **Set up a trainer training Programme** designed to foster the creation of **support structures for managing innovation projects and technology transfer, for both production processes and products, in the Bioeconomy field** (by also re-adapting and updating the role of the multipurpose agricultural advisers (pursuant to EEC regulation 270/79).

1.1.1 Agri-food

The Italian food and beverage industry represent a prominent sector of the Italian economy. It relies on a large variety of high-quality typical products, prominent components of the Mediterranean diet, which is recognized worldwide as a model of healthy and correctly balanced nutrition, permitting a good state of health, and preventing onset of significant pathologies associated with the diet. The sustainability and circularity of Italian agri-food value chains can be further increased through processing and utilization of by-products and wastes. By-products often contain phytochemicals, bioactive peptides, prebiotics, dietary fiber, minerals, polyunsaturated fatty acids,

carotenoids, etc. that can be exploited as valuable bioactive ingredients. They can be recovered and used both in the formulation of new food products, which combine health and acceptability performances, and in the increase in food safety and shelf life.

The following sub-actions are proposed in this sector:

- **Better identify/document scientifically the health and nutritional properties of the Italian regional products of the Mediterranean diet**, to further promote globally the image of this food style and its cultural, anthropological, nutritional, healthy relevance through solid scientific evidence;
- **Develop tailored biorefinery schemes to fully valorize agri-food byproducts to obtain high value healthy ingredients for the formulation of ready-to-eat and other modern new food/feed products, along with biobased products (chemicals, materials and fuels, including Bio-H₂)** of prominent interest for the pharma, biocosmetic, as well as the chemical and textile sectors;
- **Standardize methods of assessing bioavailability and functionality** (antioxidant, anti-inflammatory, immune-modulatory, neuroprotective, and anticancer properties, etc....) **of ingredients obtained from byproducts**;
- **Develop new food processing methodologies (including biobased food packaging) based on minimizing the technological damage to decrease food loss and food waste** and increase productivity, while **valorizing the unavoidable food losses into the production of high quality biomethane and compost for soil regeneration**.

1.1.2 Biobased industry

The production of bio-based products from dedicated non-food agroforestry biomass in marginal lands and from biowaste of agri-food, forestry and maritime activities, is a very special opportunity for many rural, mountain and coastal areas of the Country, under economic and environmental terms. On the one hand they can constitute a source of income diversification and an additional element of profitability for all the involved stakeholders along the value chain (including primary sector). On the other hand, they can contribute to dispose smartly impacting residues and regenerate territories, thus contrasting the phenomena of desertification and soil contamination. Moreover, in Italy more than 6 thousand contaminated sites are present, often former industrial sites (oil refineries and chemical plants). They have to be decontaminated to lower the associated environmental and health problems. The opportunity is to combine this decontamination phase with their re-industrialization, with the installation of new and advanced biorefineries, established in synergy with primary sector, providing environmental and economic regeneration of the territories through the establishment of win-win agro-industrial value chains between agriculture and biobased industry, leveraging on the valorization and enhancement of the existing infrastructures, services, skills and professionalism.

- **Create circular Bioeconomy value chains based on the valorization of dedicated non-food crops grown on marginal lands and/or local agri-food, forestry or marine biowaste to**

obtain different types of bioproducts, including bio H₂, and biomaterials to enhance and revitalize the economy and the environmental and social relevance of the areas.

- **Regenerate some of the former oil refineries or chemical industrial areas, especially those located near populous and relevant urban centers, into biorefineries able to guarantee locally new environmental, economic, and social sustainability. To spur opportunities in such direction, a public database of existing former oil refineries or chemical industrial areas in the Italian territory needs to be created.**

The forest sector plays a strategic role in providing Italy with biomass, fruits, ecosystem services and in fixing a significant portion of national carbon emissions. Thus, in the biobased area of Bioeconomy and in line with the national strategy and the European Guidelines for the forestry sector, it has to be reinforced:

- **the recovery and the recycling of wood products along with the replacement of energy-intensive industrial materials with long lasting wood-based products to reduce carbon dioxide emissions;**
- **the recovery and the recycling of wood products to produce bio-H₂ as competitive green H₂;**
- **the use of wooden products in the building and street furniture, in the furniture and toys production, etc., by extending their life cycle and taking into account their carbon storage potential.**

1.1.3 Urban Bioeconomy

Municipal biowaste, normally perceived as a challenge due to its potential pressure on the environment and human health, is a valuable soil improver in the form of compost. Moreover, it can be (bio)converted into bio-based products such as chemicals, precursors for plastics, biofuels, etc. of prominent industrial interest. In 2018, Italy produced above 2 Millions of tons of compost, which brought about 600,000 tons of organic carbon into soil by saving 3.8 Millions of tons of carbon dioxide equivalent (with respect to their disposal in dump sites); it also generated EUR 1.9 Billions of turnover and 10,620 new jobs. Similar opportunities are associated with municipal wastewaters management and disposal. The availability of such matrices is growing due to the fact that the new EU regulation on waste would lead to an increase of the amount of bio-waste collected and made available in cities (currently, above 7 M tons/year of organic fraction in the whole country) and at the same time the current approach to their exploitation is not fully valorizing their potential.

The following sub-actions are proposed in this sector:

- **Exploit the full potential of urban biowaste and wastewaters via a multi-products biorefinery approach, with the production of bio-based chemicals, materials and energy along with clean water, fertilizers, nutrients and critical materials such as nitrogen, phosphorus and potassium.**

A contribution to the bioeconomy is also played by urban and peri-urban forests which play an important role in improving the quality of life of resident populations. In this direction, it is recommended, in line with the national strategies for urban green and forestry, and in line with European guidelines, to promote management and reforestation interventions in urban and peri-urban areas.



1.1.4 Blue Bioeconomy

The EU's blue growth strategy identifies aquaculture as a sector that could stimulate economic growth across Europe and the Mediterranean region and the reform of the common fisheries policy also promotes the aquaculture sector, also through the national strategy adopted by Italy.

Aquaculture has a clear function in the development of a climate neutral, sustainable and productive Blue Economy and provides an efficient production of nutritious and healthy food, with a low product environmental and climatic footprint. In the light of the Blue Growth Strategy, the Green Deal, the Farm to Fork Strategy and the EU Ocean Mission, it is important to unlock aquaculture potential across Europe and the Mediterranean region. An improved governance and regulatory system will boost sustainable aquaculture and promote the possibilities to invest in new activities.

Italian aquaculture provides 150,000 tons of aquatic products farmed in 800 aquaculture sites based on land, transitional and coastal waters. Most of Italian production is shellfish (66% production, 55% of value), which is recognized as a bioremediation tool and provide ecosystem services leading to positive effects in transitional and marine habitats. Europe currently is a leader of sustainable aquaculture, pushing it to become the global standard for sustainability.

Italy is the second Mediterranean country for the production of fish products. However, the national fishing sector is in crisis due to the excessive exploitation of resources (caused by ineffective

management with a consequent reduction in catches, which has led to a significant contraction of the fishing fleet). The sector is also affected by the lack of technological innovation, management and marketing, in the improvement of boats and the welfare of operators. Other adverse elements are associated with the geo-politically complex Mediterranean basin, where are playing prominent non-EU fishing countries with less restrictive regulations, but also with the phenomenon of illegal fishing. We should consider that aquaculture is highly susceptible to climate change impacts (among all, seawater temperature, salinity, acidification and marine extreme events, etc.) and appropriate measure are required.

Despite the aforementioned challenges, marine environment can be considered an inexhaustible mine of products, if properly exploited, with high added value that can generate new production chains with high commercial value, and this is a special opportunity for Italy almost fully surrounded by seas. Despite of this, Italy shows a significant delay in development and technological innovation in the blue biotechnology sector.

The following sub-actions are thus proposed in this sector:

- Implement specific national strategies for the sector and **promote the development of sustainable fisheries, also through new fishing and market ICT based technologies**, aimed at achieving environmental sustainability, protection and restoration of marine habitats, spatial management of fishing activities, food quality & safety, promotion of market neglected fish species, enhancement of underutilized and discarded fishery (e.g. bivalve shells, undersized specimens of commercial fisheries species), diversification of fisheries products, promotion of products traceability and labeling, development of integrated traceability systems and of circular economy models, including through promoting circular economy framework;
- **Foster the resilience of the aquaculture sector** and its integration In the Blue economy as a key contributor to European food security.
- **Recognize aquaculture as a full-fledged part of marine spatial plans** (co-existence) and allocate marine zones for aquaculture (AZA) at regional and municipalities level, moving towards predictable and evidence-based licensing systems, in order to increase the number of coastal and offshore marine sites for sustainable growth of aquaculture, also through the reuse of decommissioned offshore platforms existing in Italy;
- **Promote incentives for the cultivation of aquatic extractive species**, such as seaweed, invertebrate, shellfish to obtaining more food and biomass sustainably and as bio-remediation tools for the restorative effect on ecosystems;
- **Improve sustainability assessment** and design performance-based food sustainability standard and labelling as well as trustful, cost-effective certification systems for benchmarking aquatic food sustainability in International and European sustainability **certification schemes of bio-based systems**.
- **Develop smart solutions for the use of digital technologies** for small and medium aquaculture farms, to support efficient management of production sites in remote coastal/rural and even off-shore areas;

- **Increase in use of by-products from aquaculture** by valorising both processed products and sludge; increase in use of renewable energy (wind, solar, waves, bio-H₂) at sea-based and rural production sites;
- Create a scientific network for applied blue biotechnology, involved in designing and testing new technologies for the remediation of marine contaminated sites and **tailored exploitation of national marine based feedstock** (including by-products and wastes from sea products transformation), **identifying new biobased products** (i.e., functional cosmetics, foods/feeds nutraceuticals, functional foods) and **biomaterials** (i.e., natural polymers for packaging or biomedical market);
- **Create a national vulnerability evaluation framework** to assess of the sector vulnerability and the integrated coastal management, **improving disaster preparedness and farm and fisheries resilience to climate change and other natural and technological hazards.**



ACTION 3

Enhance the knowledge on national biodiversity and ecosystems and on their resilience/adaptation to climate changes, to deploy it in the primary production within safe ecological limits.



The environment, natural resources, natural capital, biodiversity, ecosystems and ecosystem services are under severe pressure at global and local scale. The “Biodiversity” strategy as well the “Farm to Fork” and have been recently launched for facing these treats and to stimulate the economy, improve the health and quality of people's life, conserve nature and leave no one behind. It is therefore imperative that the Italian Bioeconomy implementation actions help reducing environmental pressures, value biodiversity, halting and reversing its loss, enrich natural capital and contribute to enhance the provision of main ecosystem services and improving the productivity and resilience of natural resources. There are several sources of soil and water pollutants/contaminants interfering with our eco-system and entering in food-feed chains, such as plastics and microplastics, chemical fertilizers and herbicides, lubricants, metals, fuels, antibiotics as well as excess of nutrients. Sustaining nature’s contribution to humanity requires the maintenance of a healthy planet, resilient ecosystems, efficient use of natural resources, and conservation and sustainable management of biodiversity. It is therefore necessary to improve the knowledge basis (data, information and tacit knowledge) on ecosystems status and their interaction, as well as a forward-looking capacity. At the same time, the application of eco-designed products which do not accumulate into the environment can provide a substantial contribution to preserve ecosystem services, when they are implemented in virtuous systems based on high quality inputs/output flows.

These are essential elements to provide the evidence needed to support policy makers and for underpinning policy consistency. This asks for more knowledge and perception about risks and opportunities of working with biological resources, sustainability thresholds and the values of biodiversity (including economic, cultural, and intrinsic values), but also for innovative solutions, new business models, new accounting systems, and alternative value chains that are centered on biological resources, ecosystems, and biodiversity, developed together with local communities and stakeholders.

The recommended actions are:

- **Protect and increase biodiversity** by appropriate management practices and habitat restoration actions, contributing to the EU Green Deal target on high diversity landscape features on agricultural land;
- **Boost sustainable forest management and restoration of forests ecosystems**, in line with the national strategy for the forestry sector and the European guidelines, to improve the condition of habitats and species linked to the forest biodiversity, contributing to increase the resilience to climate change and other adverse factors;
- **Promote** mechanisms accelerating the transition towards **a resource-efficient, safe, circular and climate-neutral economy that protects and restore biodiversity and ecosystem services**;

- **Adopt a methodological framework and standardized indicators**, endorsed by policy makers, **to measure the value of ecosystem services** provided by low-trophic levels, as Nature Based Solutions, and to align **funding mechanisms** at national and EU level to reach the targets;
- **Strengthen the knowledge, resilience and status of biodiversity and terrestrial, coastal, and marine ecosystems, including the services they can provide and the related socio-economic costs and benefits**, with a particular attention to regulatory ecosystem services, in harmony with the Italian Natural Capital Committee and the European biodiversity strategy. This would allow the implementation of an ecosystem-based approach to natural resources management, valuing the provision of ecosystem services in the frame of the environmental policies on protection of water, soil, biodiversity and habitats as well as promoting the natural capital accounting systems based on the methodologies defined by the United Nations and the European Union, also within 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**, contributing to the preparation of the periodical "Report on the state of national forests" (Article 14, Legislative Decree n. 34 of 2018), also through the integration of novel administrative, socio-economic and ecological parameters, in order to: better understand the dynamics of the whole forest sector; to provide data and information useful to make informed decision-making possible; and to facilitate the reporting commitments deriving from EU legislation and Italy's participation in multilateral processes, such as the UN conventions on climate change, desertification and biodiversity and the 2030 Agenda for Sustainable Development.
- **Increase observation capacity and monitoring and reporting capabilities on the condition of national biodiversity, ecosystems and ecosystem services**, to underpin ecosystem conservation and restoration by contributing/exploiting to Copernicus and European Marine Observation and Data network (EMODnet) data and information services, by better integrating monitoring and data systems and select key indicators for sustainable management of land and marine bio-based production, to comply with environmental assessment and to adopt a more fact-based decision making;
- **Monitor degraded land areas or lands at risk of climate change** impacts, such as desertification, in cooperation with Copernicus services and Sentinel system, to underpin **actions for soil health improvement based on circular Bioeconomy regenerative practices**;
- **Assess the national role of pollinators, microbiomes, and other ecosystem services as factors able to higher up the biomass production, to protect our crops, to restore and better manage soils, to improve human and planetary health, and to spawn new sustainable solutions** and economic opportunities for growing bioeconomies, while preserving the intrinsic value and biodiversity of our ecosystems. The national initiative on microbiomes launched by CNBBSV in 2018 and implemented with a Position Paper and an industrial Implementation Action Plan ⁴, will guide some of the activities associated with this action

⁴ <http://cnbbsv.palazzochigi.it/en/areas-of-work/bioeconomy/microbiome/>

- Support and guide innovation in the area of **protocols and technologies, species identification and improvements for biomass production, harvesting and processing to match the conditions to be met for sustainability of primary production**, assigning priority to the food use of edible resources (protecting and enhancing local species and varieties of agrobiodiversity) and preferring the structural prevention of surpluses over recovery and recycling actions;
- **Adopt /join climate policy measures at EU level in order to combat biodiversity loss and environmental changes also through the promotion of eco-designed products application which don't accumulate into the environment** preserving ecosystem services.
- **Activate the potential of forest sinks, carbon storage in forest soil and products and wood's substitution role for non-renewable and carbon-intensive materials produced by sustainable forest management of national forests and in arboriculture plants from wood.**



ACTION 4

Promote engagement, education, skills upgrading, attitude, training, and entrepreneurship across the Bioeconomy.



The recommended actions are:

Launch a "Sustainable Bioeconomy" Information System as entry point for sharing information on state and development of the main national sustainable Bioeconomy actions. It could bring together data, information and knowledge gathered or derived through key bioeconomy-related policy drivers.

CITIZENS

- **Promote citizens awareness and engagement through campaigns** to showcase Bioeconomy products, , including food products emblematic of a sustainable value-chain (e.g., carbon neutrality, adoption of circular economy practices, sustainable production practices such as sustainable fishing) in the food sector, **mobile exhibition** to showcase the Bioeconomy in day to-day life, **"open days"** in companies active in the Bioeconomy, participation to National Bioeconomy Day launched by SPRING Cluster and Assobiotec-Federchimica, and all other initiatives which aims at creating awareness in the public opinion

COMPANIES

- **Promote awareness and provide information to enterprises through:** i) the set up a sustainable **Bioeconomy portal** to gather together basic information, highlighting a large number of examples and listing R&I projects on Bioeconomy products and their applications ii) **raising the profile of bio-based products** and their externalities with retail companies to enable them to promote and offer more of them to consumers; iii) **technical information campaigns for each broad family of bio-based products** (e.g. hygiene, construction, clothing) **for downstream actors** in supply chains. iv) **take advantage of the construction of the Olympic Village for the 2026 Games** (Milano Cortina) to make Italian excellence in the Bioeconomy. Construction of the Olympic Village in bio-based materials (wood, hemp, etc.) could be an opportunity to showcase these new materials (also bioplastics and biocomposites) and techniques.

EDUCATION

- **Improve the level of training and education of personnel working in the Italian agricultural, forest and marine/maritime sectors** to meet Bioeconomy sectors needs and transformations, facilitating replacement of the ageing personnel working in the mentioned sectors (e.g. technicians, support engineers, ground-staff) with young and better trained professionals, owning multidisciplinary, managerial and cross-sectoral expertise;
- **Include the Bioeconomy both in school education and specialist vocational courses** (schools of agronomy, chemistry and biology courses, agricultural teaching, maritime studies, food studies, school education);
- **Disseminate the Bioeconomy concept in initial and continuous training courses and school programs** in partnership with the Ministry of Education and regional governments;
- **Create new Bachelors and Masters' University degree programs in Bioeconomy and better promote the existing ones**, in order to contribute in a more effective way to a smart, innovative multidisciplinary and sustainable Bioeconomy growth in the country. This will require also the support of collaborative networks of academic institutes and private sectors to share best practices and improve the development of Bioeconomy curricula;
- Intensify mobility between academia, authorities and industry **to build the blue human capital** and to attract cutting-edge professional skills in a wide range of biological, technological and social science fields and create a cross-disciplinary and cross-sectoral bioeconomy workforce.

ENTREPRENEURS

- **Promote an entrepreneurial mind-set and culture for the Bioeconomy** through the contribution of some of the Knowledge Innovation Communities (KICs) launched by the European Institute of Innovation & Technology (EIT), among others, the EIT Raw Materials, EIT Food, EIT Climate-KIC and EIT InnoEnergy, EIT Manufacturing);
- **Promote Open Innovation initiatives to accelerate a scale-up of innovative solutions** in the Bioeconomy field developed by start-up and SMEs;
- **Act to increase the EU financial support to Bioeconomy projects** in line with the recommendations of the European Investment Bank on 'Access-to-finance conditions for Investments in Bio-Based Industries and the Blue Economy'. This to improve access-to-finance of projects, by helping them to improve their bankability and investment-readiness, structuring their financing and liaising with private investors.

FLAGSHIP PROJECTS TO BE DEPLOYED IN THE SHORT TERM

Some ready, concrete and replicable projects have emerged so far from a consultation launched by the National Technology Clusters Agri-food, Green Chemistry and Blue Growth joining the NBCB; if properly catalyzed and supported by public-private investments, these projects can contribute significantly to the new economic recovery of the country after the health emergency. These **projects provide for investments totaling of about EUR 2.000 Million** and are aimed at:


- **the adaptation and development of infrastructures for the recovery and treatment of organic matter** and other fundamental nutrients in the liquid and solid flows of **organic waste, urban and industrial waste water and sludge;**
- **the creation of territorial value chains interconnected with national multi-input and multi-product biorefineries** capable of transforming waste and co-products destined to become waste, as well as nonfood biomass from marginal soils into sustainable products designed to not pollute the liquid and solid carbon flows;
- **the reconversion of industrial sites in crisis in synergy with the agricultural sector;**
- **the regeneration of the Adriatic-Ionian marine macro-region with its decontamination** from plastic, waste and war residues **and the sustainable reinforcement of fisheries and aquaculture value chains of the area;**
- **the integrated and multipurpose valorization of by-products and waste of the Italian meat and wine value chains** with the production of food ingredients and high added value products along with biofuels and fertilizers.


There are several elements of resilience on which the projects proposed on the Italian national territory are based, and described below:

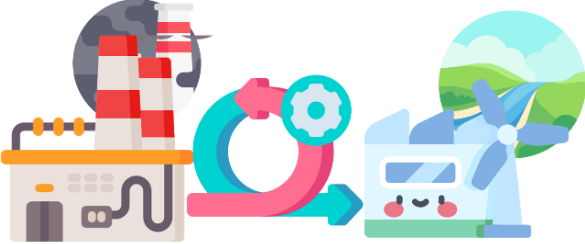
- **Synergy between rural, coastal, industrial, and urban areas, overcoming the competition for resources:** interventions aimed at the growth and innovation of the circular Bioeconomy are not designed to promote a single production sector or a single territory but rather to **enhance the competitiveness of entire value chains**. Agricultural, food, forestry, fishing, wastewater, and waste management sectors are involved both upstream and downstream of the supply chains both as bio-resource suppliers and as recipients of technologically advanced low impact biobased and eco-designed products necessary, for example, for the preservation of food and agricultural products, packaging, health aspects, etc.
- **Transformation of costs into value:** the virtuous interconnection of different economically relevant national realities which previously presented themselves to the market as isolated and independent realities allows **to transform costs (see waste disposal, by-products, etc.) into value and maintain it on the national territory**
- **Development and growth with the territory and not in the territory:** the creation of the value chains of the circular Bioeconomy catalyzed by incremental innovation allows for a **cohesive and sustainable development, also through trans-regional coordination that enhances the specific characteristics of the individual territories system**

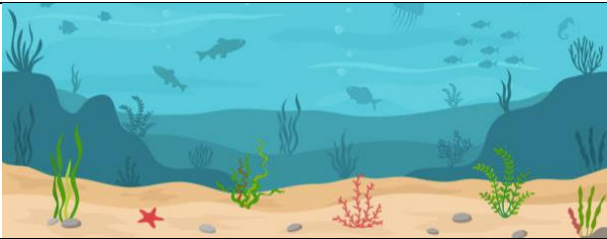
- **Terrestrial and marine ecosystem restoration activities and programs:** the activities of the Bioeconomy allow to reduce environmental pollution, land and aquatic CO₂ sequestration and allowing the sustainable disposal of civil and industrial organic waste and wastewater with the **concomitant production of biodegradable and compostable materials that do not accumulate in soil and water and which, at the end of their life, can be transformed into precious compost for soil regeneration**, contributing to the prevention and containment of future zoonoses and epidemics.




	FLAGSHIP 1 – CREATION OF REGIONAL VALUE CHAINS INTERCONNECTED WITH MULTI-INPUTS AND MULTI-PRODUCTS BIOREFINERIES	
	INVESTMENT	~ 150 M €
TARGET	EXPECTED IMPACTS	
<p>Develop multi-purpose and multi-product biorefineries capable of converting, through biotechnological and chemical processes, renewable raw materials into low-impact biobased products conceived as solutions to specific environmental problems, enhancing cascade all the streams leaving the biorefinery (including waste), increasing energy efficiency, all in environmentally safe and highly efficient "biorefinery" zero waste logic.</p> <p>In this perspective, the establishment of supply chains in agreement with a circular bioeconomy logic based on dedicated industrial crops in marginal areas not in competition with the food supply chain is an effective solution for enhancing and revitalizing the soil resources, especially in fragile territories of southern Italy (also through the integrated growth of industrial and food crops), and to generate new business models based on synergies between agricultural and industrial sectors. In addition, the opportunity to valorise additional agricultural and/or forestry by-products and waste, and marine biomass, particularly interesting for the extraction of high biological value and high value-added molecules.</p>	<ul style="list-style-type: none"> ▪ Significant opportunity for the creation of new jobs, many of which specialized, both in the primary sector for the production and management of biomass, and within the biorefinery itself ▪ Generation of new sources of income for primary and secondary sector players and enhancement of districts/territories. ▪ Activation of highly specialized production chains, which can also be replicated in different production contexts. ▪ Recovery and restoration of marginal, abandoned or degraded/desertified lands and prevention of hydrogeological instability through their rehabilitation. ▪ Development of technological solutions on an industrial scale for the implementation of second generation biorefineries ▪ Obtaining bioproducts and/or high added value molecules with wide market potential ▪ Reduction of the dependence on fossil sources for the sectors of application of the products defined in the process ▪ Reduction of management and disposal costs of organic waste and residues from different agro-industrial sectors ▪ Creation of supply chain certification systems aimed at guaranteeing the real use and marketing of the bioproducts developed. 	

		FLAGSHIP 2 – URBAN BIOWASTE AND WASTEWATER/SLUDGES VALORISATION INTO COMPOST, BIOCHAR, BIOMETHANE, CHEMICAL SUBSTANCES AND MATERIALS FOR THE BENEFIT OF THE LOCAL AREAS	
		INVESTMENT	~ 250 M € (for the upgrade of existing plants) + 880-1.760 M € (for new plants for anaerobic digestion and composting mostly in the southern Regions)
TARGET		EXPECTED IMPACTS	
To develop industrial bioeconomic threads in the area for the enhancement of biodegradable municipal waste (organic fraction of municipal solid waste (OFMSW), sewage sludge, garden waste, and other organic waste streams) in the production of low impact and secure bio-based products market shares (e.g., natural organic soil improvers, renewable mineral and organo-mineral fertilizers, biostimulants, renewable biochemicals, biomethane , CO ₂ , etc.).		<ul style="list-style-type: none">▪ New investment opportunities and employment effects for all stakeholders involved in the supply chain (e.g., waste managers, multi-utilities, technologies and processes developers, large, small and medium-sized enterprises, innovative start-ups, trade associations, research and technology transfer centres)▪ Significant reduction, as required by the circular economy package, of the problems of disposal of different types of biomass and organic waste of urban origin, such as OFMSW, anaerobic digestates, sewage sludge, garden waste, etc.▪ Proper transformation of municipal wastewater sludge into quality compost and/or source for phosphate▪ Significant reduction in the amount of process waste generated during the treatment of organic waste.▪ Potential integration of the technological chain with existing and currently underutilized plants (e.g. anaerobic sludge digesters in wastewater treatment plants). Reduction of climate-changing emissions associated with current treatment processes and enhancement of the storage of Total Organic Carbon into soils;▪ Promote the implementation of advanced and innovative technologies aimed at optimising organic waste recycling, considering that recycling of bio-waste is key for meeting the EU target to recycle 65 % of municipal waste by 2035;▪ Maintenance and improvement of the ecosystemic services of agricultural, urban and industrial soils.	

	FLAGSHIP 3 – RECONVERSION OF INDUSTRIAL SITES IN CRISIS THROUGH THE BIOECONOMY	
	INVESTMENT	~ 170 M €
TARGET	EXPECTED IMPACTS	
<p>Redevelop the old Italian non-productive industrial plants converting them to the specific needs of the innovative value chain of biobased products, in connection with the agriculture: focus the efforts on marginal lands that are not in competition with food chain, in full respect of local biodiversity and slowing down the erosion of soil and agricultural surfaces.</p>	<ul style="list-style-type: none"> ▪ Significant opportunity for the creation of new jobs, many of which specialize, both in the primary sector for the production and management of biomass, and within the biorefinery itself. ▪ Revitalize the local economy ▪ Insert the remediation into the general framework of the protection of environmental resources. Ensure the recovery of areas reclaimed for productive use ▪ Guarantee the economic and temporal sustainability of the interventions by ensuring full compatibility with the activities in place in the areas ▪ Evaluate and minimize secondary impacts. 	

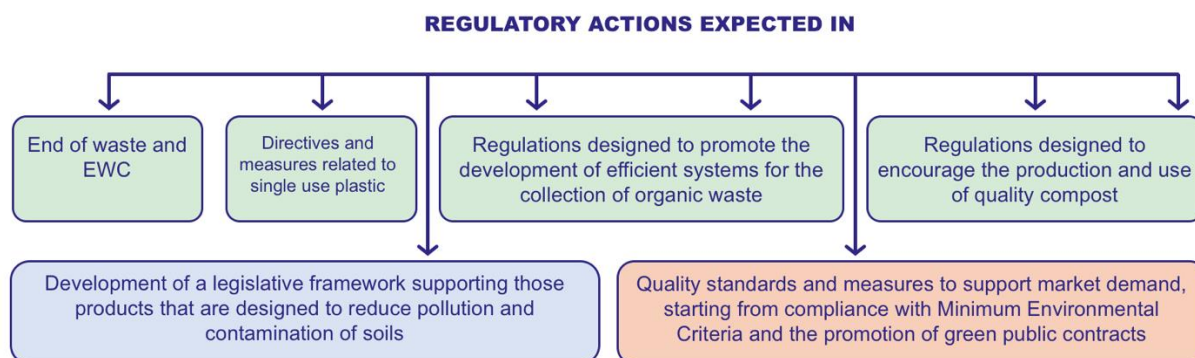
	FLAGSHIP 4 – RESTORATION OF THE MARINE ECOSYSTEM OF THE ADRIATIC-IONIAN MACRO REGION	
	INVESTMENT	~ 20 M €
TARGET	EXPECTED IMPACTS	
<p>This flagship will involve the entrepreneurial and industrial systems of blue economy interested in the recovery of plastics wastes, solid (urban) waste including war residues and dangerous wastes, abandoned or / and lost fishing nets and waste collected from the sea. New business opportunities will be developed from the valorization of the collected plastics (with the production of chemical compounds and material of interest for the textiles and fashion, and biofuels) and wastes. Another priority addressed would be the (bio)remediation of the contaminated marine sediments, with particular those coming from the port dredging operations.</p> <p>The initiative will be implemented in close cooperation with the EU and non-EU cross-border regions, in order to create a macro-regional (Adriatic-Ionian) consensus on prevention and management of anthropogenic and plastic waste in the sea and on the actions and R&I needs to put on place. A transnational response in the Balkan region, coordinated by Italy, could increase the effectiveness of interventions through the sharing of experiences, professionalism and skills.</p>	<ul style="list-style-type: none"> ▪ to implement and promote ecological restoration of degraded marine areas; ▪ to improve the health conditions of marine fauna, threatened by the plastic wastes as well as the human consumption of fish products; ▪ the promotion and active involvement of coastal and fishing communities, through the redevelopment of fishing ports currently in crisis; ▪ the adaptation and implementation of infrastructures in the ports for the recovery and valorisation of anthropogenic waste, plastic and other waste (i.e., fishing waste); ▪ the implementation of territorial supply chains capable of transforming plastics collected from the sea into eco-products and materials of interest for textile, fashion, chemical and energy industries, multi-input and multi-output biorefineries; ▪ the promotion and development and adoption of clear and stable regulatory frameworks, policies, high quality standards and demand support measures for the innovative and sustainable products coming from the valorisation of the plastics and waste recovered from the sea; ▪ to drive the fishing and aquaculture sectors towards technological innovation on the recovery and valorisation of waste from fishing, aquaculture and the fish processing industry with the production of compounds and molecules of high nutritional and commercial value to be used in the health, cosmetic and food sectors. 	

	FLAGSHIP 5 – CIRCULAR AND SUSTAINABLE AGRI-FOOD CHAINS	
	INVESTMENT	~ 25 M €
TARGET	EXPECTED IMPACTS	
<p>The project involves the complete revamping of 2 existing transformation plants - anaerobic digestion and composting, to make them integrated and complementary, to allow the joint recovery of organic waste, waste and by-products of agri-food and urban origin to produce renewable energy (bio-methane) and high quality organic amendments, to be reinserted into the supply value chain by the wine and livestock sectors.</p> <p>The main objectives are: renovate and valorize existing industrial assets no longer used or underused, exploit the chemical complementary richness of carbon and nitrogen nutrients of the by-products of the wine and livestock sectors, increase the competitiveness and sustainability of the Italian wine and meat supply chains by reducing their carbon footprint along with the creation of a national integrated hub for the valorization of waste and scraps at the service of the whole Italian agri-food system and a reproducible model for energy conversion and technological adaptation of the national network of first generation agricultural and agri-food biogas plants.</p>	<ul style="list-style-type: none"> ▪ Generate revenues of approximately € 6.5 million including the biomethane and related incentives provided for by the Ministerial Decree of 2 March 2018, waste and scrap recovery service, as well as the sale of soil improvers. ▪ Obtain the efficient disposal and valorisation of over than 100,000 tons/year of highly impacting biowaste, scraps and by-products of animal origin from the agri-food and civil sector from all over the Country; ▪ Produce 12,000 tons / year of organic amendments to be reintroduced into primary production; ▪ Produce 3,500,000 cubic meters of biomethane obtained from renewable sources; ▪ To develop innovative solutions for the recovery of bioactive molecules and ingredients from by- products of the wine making and animal processing pipelines. ▪ The direct employment impact involved in the management of the production sites is about 12 people; indirect resources employed in the design, technical assistance and maintenance of the processes are 15 people. ▪ To assess innovative and sustainable technical solution for cat.1 animal by-product alternative to incineration that is facing increasing difficulties due to a lack of specific plants and air pollution concerns. 	

PROPOSALS FOR OVERCOMING LEGISLATIVE BARRIERS

Despite all the actions put in place and investments in new plants and among the most important projects in Europe, there is still no clear and stable legislative framework, an essential element to encourage investment. Barriers include the still insufficient diffusion of high quality standards for circular and bio-based products, demand support measures that allow innovative and sustainable products to compete with existing ones, measures to emergence and limit environmental costs and externalities, promoting the circularity of the economy and the reduction of environmental impacts (e.g. incentives for activities that contribute to increasing the sequestration of carbon in the soil, such as the production and use of quality compost) . Other obstacles concern the incomplete application of laws already in force and related sanctions and the lack of homogeneity of the authorization approach regarding End of Waste (EoW) due to the discretion of the various. This chapter lists some priorities identified by the Cluster members that hold back the development of a virtuous circular Bioeconomy systems, suggesting some actions that may favour market access for biobased Bioeconomy products.

1. **End of waste;**
2. **Directives and measures related to single use plastics;**
3. **Regulations designed to promote the development of efficient systems for the collection of organic waste** and the construction of technologically advanced treatment plants, in order to expand the collection and treatment capacity of this fraction throughout the national territory;
4. **Regulations designed to encourage the production and use of quality compost** obtained from the treatment of organic waste and wastewater sludge;
5. **Quality standards and measures to support market demand, starting from compliance with Minimum Environmental Criteria and the promotion of green public contracts**, with particular reference to waste treatment, recovery and disposal systems;
6. Development of a legislative framework **promoting eco-design and supporting those products that are designed to reduce pollution and contamination of soils.**



End of Waste

The End of waste is a process that allows a given waste to lose this qualification in order to become a non-waste, that is, a new resource, transforming a cost into a new value. Italy has transposed the legislative procedure aimed at defining the EoW criteria, however no national decrees have been adopted for biodegradable waste streams yet.

This limitation can represent an obstacle to the development of the Bioeconomy sector, which uses biological resources and waste as inputs for energy, industrial, food and feed production, following a "cascade" approach and the valorisation of secondary raw materials. In the same way, the Bioeconomy by its nature is a sector that in terms of produced wastewater and sludges is comparable to the agro-food sector since it uses and transforms vegetable and animal raw materials whose waste can present characteristics suitable for further use in other chains.

The lack of specific regulatory procedure slows down the development of an integrated Bioeconomy as well as the application of the principles of the circular economy. It follows that the country that has developed correct and well-defined regulations will be the one that will take advantage of these technological changes and will enjoy the consequent economic benefits. What is generally desirable is a complete change in the economic paradigm, which goes beyond the concept of waste by transforming it into that of resource, a raw material that offers great opportunities for sustainable development. Therefore, it is proposed to define an EoW decree for waste and recovery

activities of interest to the Bioeconomy, or alternatively to insert these issues within an already active Working Group within the Ministry itself.

Moreover, legislative intervention could be coupled with fiscal or other incentive mechanisms to compensate the cost/price gaps in order to promote the use of bio-based products based on EoW materials.

Some critical issues that need a solution are:

a) the bioeconomy activities do not appear well described through the ateco codification and even the waste list does not allow to identify the waste generated by these activities;

b) coherence and coordination between national and regional regulations, to make the measures implemented at National level fully applicable.

Directives and measures relating to single use plastics

The single use plastics directive - (SUP)⁵, more precisely Directive (EU) 2019/904 of June 5th 2019, published in the OJEU on 12 June 2019, regulates a part of disposable plastic products, some of which are subject to reduction goals (art. 4), others are banned (prohibitions of art. 5), and still others are subject to specific collection, recycling, etc. requirements (articles 6 ss.). Italy is the European Country most affected by the measures provided for by art. 5 due to the presence on its territory of major producers of disposable tableware at the European level. According to the available data, "The Italian industry producing disposable plastic tableware is the most important in Europe with an export share of over 30%".

It is important to consider and discuss about the activation of measures that do not put the national system in crisis, but at the same time push the innovation of the production chains with a view of environmental protection.⁶

Moreover, with the goal of developing an integrated cycle for the complete collection and valorisation of organic waste⁷ it is necessary to introduce even clearer labelling systems that favour the correct management of bioplastics in its end of life, in compliance with existing standards and with particular regards to their properties of biodegradability and compostability in a way to favour a correct separate collection.⁸

⁵ Directive (EU) 2019/904 of the European Parliament and of the Council - <https://eur-lex.europa.eu/legal-content/IT/TXT/HTML/?uri=CELEX:32019L0904&from=EN>

⁶ ISPRA data highlights that the separately collected OFMSW is sent to industrial composting plants (3.1 Million tons in 2019) or in integrated anaerobic digestion/composting plants (2.9 Million tons in 2019) or in anaerobic digestion plants (0.3 Million tons in 2019).

⁷ According to ISPRA's Municipal Waste Report Ed. 2020, in Italy almost 7.3 Million tons of OFMSW were collected in Italy, with an increase of 3.1% compared to 2018. With reference to the entire period 2010 – 2019 there was an average annual increase in the collection of the organic fraction equal to 6.4%, higher than that recorded for all the other fractions. This is a sustained and constant growth trend. In terms of efficiency increase of the management system of the organic fraction as a whole, in Italy in the years 2010-2019, the average share of the collected OFMSW rose from 36% to 68% compared to the total present in municipal waste.

⁸ Following the publication of Directive (EU) 904/2019 on disposable articles, in Italy numerous other types of compostable products are now being marketed as an alternative to traditional disposable plastics. If Italy would transpose the directive by exempting compostable bioplastics alternatives to protect a well-represented production sector in our country and favor its transition to the circular bioeconomy, it would be reasonable to envision an impact on the OFMSW treatment for a total volume of disposable compostable products of less than 100,000 tons per year, which would add to those of flexible films. It should also be taken into account that compostable alternatives to traditional plastics will also, and probably to an even greater extent, be represented by cellulosic-based products and combinations of the two materials or cellulosic packaging laminated with compostable biopolymers. The strategic role of compostability and certification of this according to the aforementioned standards is therefore clear in certain products and packaging to improve the quality of the OFMSW and increase the recyclability of certain types of food packaging.

Regulations designed to promote the development of efficient systems for the collection of organic waste and the construction of technologically advanced treatment plants, in order to expand the collection and treatment capacity of this fraction

In particular, concerning the transposition of the European Directive relating to the Circular Economy Package, in the area of organic waste it is desirable to:

- To enable bio-waste to be used as a source of high-quality fertiliser and soil improver, it needs to be collected separately at source while keeping impurity levels low. Implementing a separate bio-waste collection system is essential to obtain high quality outputs.
- Organic waste represents a fundamental share for meeting national recycling targets of municipal waste and packaging waste, when it fulfils the criteria of biodegradability and

compostability (and therefore subjected to composting and / or anaerobic digestion operations).⁹

- Invite the national government to proceed with the assessment of needs in terms of plants for the treatment of organic waste and the subsequent collaboration with the regional, local authorities and with the public and private subjects involved in the research and in the promotion of new settlements necessary to cover the identified needs, in accordance with Article 198bis of legislative decree 152/2006.¹⁰

Regulations designed to encourage the production and use of quality compost obtained from the treatment of organic waste

The production and use of quality compost obtained from the treatment of organic waste and wastewater sludge makes it possible to return organic matter to the soil, representing a concrete way to improve the quality of the soil and protect it. To achieve this goal, the indications summarized below provided by the Italy Towards Zero Organic Waste in

Landfill strategy, promoted in 2016 by the Kyoto Club and the Foundation for Sustainable Development, could be adopted:

- Encourage the separate collection by ensuring that the waste is not mixed with other types of waste¹¹ also making the users to be responsible for the sorting through the

⁹ 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".

¹⁰ According to the estimations of the CIC (Italian Composting Consortium) carried out on the basis of ISPRA data only the Regions of Marche, Lazio and Campania currently present a plant deficiency equal to 1,100,000 tons / year compared to the collected materials. If the estimation would have concerned the difference between the treated and the potentially processable OFMSW (with the extension of separate

waste collection to the whole population, as required by EU standard), the plant capacity required in the Center-South would increase as follows: Marche 150,000 tons/year; Lazio 720,000 tons/year; Campania 770,000 tons/year; Puglia 130,000 tons/year; Basilicata 80,000 tons/year; Calabria 120,000 tons/year; Sicilia 480,000 tons/year. Only these regions have a prospect, i.e. by 2025 with the extension to the whole territory of separate waste collection, a plant engineering need which should allow a total of 2,450,000 tons/year of organic waste to be treated.

¹¹ As required by article 22 of Directive 851/2018.

introduction of tariff systems and periodic communication campaigns.

- Allocate funding for the development of plant for composting and anaerobic digestion alongside other innovative solutions aimed at increasing the use of the organic fraction as a resource for obtaining new products and intermediates with high added value.¹²
- Guarantee the high quality of the organic fraction by organizing monitoring and

surveillance systems with respect to the use of compostable bags according to the law.

- Support agronomic practices or use of products in agriculture that allow to bring back organic carbon in the soil to restore its fertility.
- Recover phosphates from ashes of heat-treated municipal wastewater sludge, when not suitable for quality compost production.

¹² The Italian Composting Consortium (CIC) estimates that by 2025 Italy will have to treat about 11.5 Million tons/year of OFMSW, sludge and other waste in composting and anaerobic digestion. Overall, the CIC estimates a need for plants to be able to treat 13.2 Million tons/year which will require the construction of an additional 50 plants, estimated by considering an average size of 30,000 tons/year for composting only plant and 60,000 tons/year for integrated composting

and anaerobic digestion plant (assuming an equal division of the two types). In addition to the investments for new plants, the system must necessarily meet a series of technological innovations of the existing plant park, in order to respond to the new BAT (Best Available Techniques), the new Fertilizer Regulation (Reg 1009/2019), in addition to satisfy the implementation of the Circular Economy Package (including Directive 851/2018).

Quality standards and measures to support demand, starting from compliance with Minimum Environmental Criteria and the promotion of green public contracts, with particular reference to waste treatment, recovery and disposal systems.

The Minimum Environmental Criteria (CAM) are the environmental requirements defined for the different steps of the process of Green Public Procurement, aimed at identifying the best design solution, product or service from an environmental point of view throughout the life cycle, taking into account the market availability.

In Italy, the effectiveness of CAM has been ensured thanks to a legislative act¹³ which made it mandatory for 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 in the objective of promoting more sustainable, "circular" production and consumption models and in spreading employment "green".

It would be desirable for greater support for the application of these criteria by the municipalities, through the definition of less restrictive and clearer requirements and greater training for those responsible for purchasing, especially in small-sized municipalities.

Development of a legislative framework supporting those products that are designed to reduce pollution and contamination of soils.

Some categories of Bioeconomy products are specifically designed to protect soil from pollution and contamination. As an example, biodegradable mulch films are designed to be incorporated into the soil after use, without releasing residues, and reducing the production of a plastic waste that is difficult to recycle. Biolubricants are the optimal solution for all machinery operating in ecologically sensitive areas such as agricultural, forest,

marine or urban areas, since in the event of accidental dispersion in the environment they biodegrade in a few days without leaving any trace.

In lights of the desertification and pollution issues that affect our soils, the use of products that do not accumulate in soil and protect them in case of accidental release should be promoted and supported through policy actions.

¹³ 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),

MEASURES TO MAXIMIZE ACTIONS IMPACTS

8.1 Action Plan Communication and Dissemination

This IAP will be presented in a dedicated event hosted by the Presidency of Council of Ministers in the first semester of the 2021 and open to any national and international stakeholders interested in being involved in the implementation process. The NBCB will then hold a public forum every year in order to stimulate the research/industrial/primary producers/education and citizen communities to share their needs and thus contributing to improvement and implementation of proposed actions.

8.2 Action Plan monitoring and controlling

Coordination and monitoring of the actions put in place in this IAP will be carried out in accordance with criteria and indicators discussed in Chapter 7 of BIT II, under the responsibility of the NBCB of the Presidency of Council of Ministers. The actions, recommendations and action plan have a focus on addressing the strategic actions and on aligning actors, territories, and value chains. To ensure the effective delivery of the strategic objectives of the present IAP, NBCB will review the implementation actions in progress every year and will report regularly on the progress, by also adapting or discontinuing activities that do not contribute to the objectives of the IAP in a satisfactory manner.

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