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**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

Innovating for Sustainable Growth: A Bioeconomy for Europe

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STRATEGY FOR "INNOVATING FOR SUSTAINABLE GROWTH: A BIOECONOMY FOR EUROPE"

1. A BIOECONOMY STRATEGY FOR EUROPE

In order to cope with an increasing global population, rapid depletion of many resources, increasing environmental pressures and climate change, Europe needs to radically change its approach to production, consumption, processing, storage, recycling and disposal of biological resources. The Europe 2020 Strategy calls for a bioeconomy as a key element for smart and green growth in Europe. Advancements in bioeconomy research and innovation uptake will allow Europe to improve the management of its renewable biological resources and to open new and diversified markets in food and bio-based products. Establishing a bioeconomy in Europe holds a great potential: it can maintain and create economic growth and jobs in rural, coastal and industrial areas, reduce fossil fuel dependence and improve the economic and environmental sustainability of primary production¹ and processing industries. The bioeconomy thus contributes significantly to the objectives of the Europe 2020 flagship initiatives "Innovation Union" and "A Resource Efficient Europe".

The Bioeconomy Strategy and its Action Plan aim to pave the way to a more innovative, resource efficient and competitive society that reconciles food security with the sustainable use of renewable resources for industrial purposes, while ensuring environmental protection. They will inform research and innovation agendas in bioeconomy sectors and contribute to a more coherent policy environment, better interrelations between national, EU and global bioeconomy policies and a more engaged public dialogue. They will seek synergies and respect complementarities with other policy areas, instruments and funding sources, which share and address the same objectives, such as the Common Agricultural and Fisheries Policies (CAP and CFP), the Integrated Maritime Policy (IMP), environmental, industrial, employment, energy and health policies.

The Strategy builds on the Seventh Framework Programme for Research and Technological Development (FP7) and the EU Framework Programme for Research and Innovation (Horizon 2020). More detailed information on the Bioeconomy Strategy is included in the accompanying Staff Working Document (SWD).

1.1. What are the stakes?

Europe is confronted with an unprecedented and unsustainable exploitation of its natural resources, significant and potentially irreversible changes to its climate and a continued loss in biodiversity that threaten the stability of the living systems on which it depends. This is exacerbated by a world population expected to increase by more than 30% in the next 40

¹ Note: Primary production in the context of this communication includes agriculture, forestry, fisheries and aquaculture.

years, from 7 billion in 2012 to more than 9 billion in 2050. Overcoming these complex and inter-connected challenges requires research and innovation in order to achieve rapid, concerted and sustained changes in lifestyle and resource use that cut across all levels of society and the economy. The welfare and well-being of Europe's citizens and that of future generations will depend on how the required transformations will be made.

Over the last decades, many policies have been put in place or revised by the EU to tackle these challenges and drive the transformation of the European economy. However, the complex inter-dependencies that exist between challenges can lead to trade-offs, such as the controversy about competing uses of biomass. The latter arose from concerns about the potential impact on food security of the growing demand for renewable biological resources driven by other sectors, the use of scarce natural resources and the environment in Europe and third countries. Addressing such multi-dimensional issues requires a strategic and comprehensive approach involving different policies. Well-informed interaction is needed to promote consistency between policies, reduce duplication and improve the speed and spread of innovation. In particular, more interaction and better alignment is needed between EU research and innovation and the priorities of bioeconomy supporting policies.

The bioeconomy provides a useful basis for such an approach, as it encompasses the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products² and bioenergy. Its sectors and industries³ have strong innovation potential due to their use of a wide range of sciences, enabling and industrial technologies⁴, along with local and tacit knowledge.

1.2. Tackling societal challenges

The bioeconomy's cross-cutting nature offers a unique opportunity to comprehensively address inter-connected societal challenges such as food security, natural resource scarcity, fossil resource dependence and climate change, while achieving sustainable economic growth.

Ensuring food security

Global population growth by 2050 is estimated to lead to a 70% increase in food demand, which includes a projected twofold increase in world meat consumption. The Bioeconomy Strategy will contribute to a global approach in meeting this challenge by developing the knowledge-base for a sustainable increase in primary production, taking into account all options from cutting-edge science to local and tacit knowledge. It will also encourage changes in production and consumption patterns and the development of healthier and more sustainable diets.

The EU food manufacturing sector and households alone waste about 90 million tonnes of food annually or 180 kg per person, not taking into account losses in agriculture and fisheries. The Strategy will support more resource-efficient food supply chains in line with the Roadmap to a Resource Efficient Europe and the Blue Growth Initiative.

² Note: Bio-based products are products that are wholly or partly derived from materials of biological origin, excluding materials embedded in geological formations and/or fossilised, CEN - Report on Mandate M/429

³ The bioeconomy includes the sectors of agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries.

⁴ The bioeconomy relies on life sciences, agronomy, ecology, food science and social sciences, biotechnology, nanotechnology, information and communication technologies (ICT), and engineering.

Managing natural resources sustainably

Agriculture, forestry, fisheries and aquaculture require several essential and limited resources to produce biomass. These include land, sea space, fertile and functioning soils, water and healthy ecosystems, but also resources such as minerals and energy for the production of fertilisers. Their use also involves significant opportunity costs linked to the depletion or loss of ecosystem services. As competing uses of biomass and the legacy of past exploitation place these resources under severe pressure, the EU needs to produce "more with less" and develop smart sustainable farming, fisheries and aquaculture.

The Bioeconomy Strategy aims to improve the knowledge base and foster innovation to achieve productivity increases while ensuring sustainable resource use and alleviating stress on the environment. Declining biodiversity can significantly degrade the quality of resources while constraining the yields of primary production, particularly in forestry and fisheries. The Strategy will thus support the implementation of an ecosystem-based management. It will seek synergies and complementarities with the CAP, the CFP, the IMP and EU environmental policies on resource efficiency, sustainable use of natural resources, protection of biodiversity and habitats, as well as provision of ecosystem services.

Global challenges demand global solutions. The Bioeconomy Strategy will support a global approach to more sustainable resource use. This will include developing an internationally shared understanding of biomass sustainability and best practices to open new markets, diversify production and address long term food security issues.

Reducing dependence on non-renewable resources

The European economy relies heavily on fossil resources as carbon and energy sources, making it vulnerable to insecure and dwindling supplies and market volatility. To remain competitive, the EU needs to become a low carbon society where resource efficient industries, bio-based products and bioenergy all contribute to green growth and competitiveness.

The Bioeconomy Strategy will include the results of the Lead Market Initiative on Bio-based Products and support the Blue Growth initiative, the Renewable Energy and Fuel Quality Directives' targets and the Strategic Energy Technology plan by improving the knowledge-base and fostering innovation for producing quality biomass (e.g. industrial crops) at a competitive price without compromising food security, adding pressure to primary production and the environment, or distorting markets in favour of energy uses. Furthermore, it will help understand current and future biomass availability and demand and competition between biomass uses, including their climate change mitigation potential, in order to ensure the long-term success of the bioeconomy. This includes making alternative sources of carbon and energy more accessible (e.g. agricultural and forestry residues, wastes) and driving research into renewable resources, such as microalgae.

Mitigating and adapting to climate change

As global demand for biomass for food and industrial purposes grows over the coming decades, EU agriculture, forestry, fisheries and aquaculture capacity will need to be sustainably increased. The Bioeconomy Strategy supports the development of production systems with reduced greenhouse gases (GHG) emissions, adapted to and mitigating the adverse impacts of climate change, such as droughts and floods. It will thus contribute to the objectives of the Roadmaps for moving to a low-carbon economy in 2050 and to a Resource Efficient Europe, as well as to the EU climate change policy. This will include increased

carbon sequestration in agricultural soils, sea beds and the appropriate enhancement of forest resources.

The EU pulp and paper, chemical and food industries emit significant amounts of GHG, but also store important amounts of carbon in their products. The Strategy will also promote the substitution of carbon, energy and water intensive production processes by more resource efficient and environmentally friendly ones wherever possible. The partial replacement of non-renewable products by more sustainable bio-based ones should be pursued.

Creating jobs and maintaining European competitiveness

The EU's bioeconomy sectors are worth € 2 trillion in annual turnover and account for more than 22 million jobs and approximately 9% of the workforce. However, in order to remain competitive and maintain jobs in the light of major societal challenges and rising markets in the developing world, the European bioeconomy sectors need to innovate and further diversify. Significant growth is expected to arise from sustainable primary production, food processing and industrial biotechnology and biorefineries, which lead to new bio-based industries, transform existing ones, and open new markets for bio-based products. New high skilled jobs and training options need to be developed to meet labour demands in these industries, as well as in agriculture, forestry, fisheries and aquaculture.

It is estimated that direct research funding associated to the Bioeconomy Strategy under Horizon 2020 could generate about 130 000 jobs and € 45 billions in value added in bioeconomy sectors by 2025⁵. Further growth is expected from other – direct and indirect – public and private investments in all parts of the bioeconomy. It can be expected that bioeconomy sectors will significantly contribute to achieving the Europe 2020 objectives.

1.3. Developing a coherent bioeconomy

Specific actions are needed to maximise the impact of bioeconomy research and innovation. In line with the recommendations of the public consultation on the bioeconomy, a more coherent policy framework, increase in research investments, development of bio-based markets and better communication with the public should be prioritised⁶.

Coherent policy

The bioeconomy encompasses a wide range of established and emerging policy areas at global, EU, national and regional level which share and adhere to its objectives, yet result in a complex and sometimes fragmented policy environment. The Bioeconomy Strategy calls for a more informed dialogue, in particular on the role of scientific advancement, and better interaction between existing bioeconomy-supporting policies at EU and Member States level (see Action 5). This will provide stakeholders with a more coherent policy framework and encourage private investment. Furthermore, information systems will need to be created, building on existing but often unconnected databases, to monitor the progress of the bioeconomy (see Action 6).

⁵ Further details can be found in the accompanying SWD. [Include reference number?]

⁶ Conclusions of the European Commission Public Consultation "Bio-based economy for Europe: state of play and future potential" (Feb-May 2011).

The Bioeconomy Strategy will support better alignment of EU research and innovation funding with established priorities of bioeconomy-related policies. In the same way, it will ensure that innovation is taken into account at the onset of policy development. The upcoming European Innovation Partnerships (EIPs) will have a key role in this respect, as will Joint Programming Initiatives (JPIs). A bioeconomy dialogue that improves the knowledge base and fosters informed interaction between policy measures at EU, Member State and regional level will also provide further stimulus for growth and incentives for investments (see Action 2).

The global dimension of the societal challenges that the bioeconomy is addressing requires reinforced cooperation at international level. The Bioeconomy Strategy will assist Europe in taking a leading role in promoting the transition towards a global bioeconomy. The existing international cooperation on bioeconomy matters will need to be driven by research and innovation and facilitate exchange of scientific knowledge and sharing of best practices on global issues and policy areas, in particular regarding food security, climate change, environment and resources, capacity building and trade (see Action 8).

Investment in knowledge, innovation and skills

The bioeconomy requires continued and increasing support from public funding and private investment and must contribute to better coherence between national, European and global research and innovation efforts. Research and the application of its results are often disconnected due to an information and knowledge gap and institutional and conceptual barrier between researchers, innovators, producers, end-users, policy-makers and the civil society. Knowledge transfer networks, knowledge and technology brokers, as well as social enterprises, embedded in broader citizens and stakeholder initiatives, can bridge these gaps. Many promising research results also remain unexploited due to pending legislative issues and patenting. Furthermore, more investment is needed for demonstration and scale-up activities and the development of entrepreneurship and advisory services for the whole supply chain. (See Actions 3 and 11)

The need to increase public funding for bioeconomy research and innovation has been recognised under Horizon 2020: Almost € 4.7 billion has been proposed for the Challenge "Food security, sustainable agriculture, marine and maritime research, and the bioeconomy"⁷. There will be further support under elements of the Challenges "Climate action, resource efficiency and raw materials", "Secure, clean and efficient energy" and "Health, demographic changes and wellbeing". The European Institute of Innovation and Technology (EIT) with its Knowledge and Innovation Communities (KICs) in different areas will address questions related to the bioeconomy, in particular under the proposed KIC "Food4future". This will be complemented by research and innovation in enabling and industrial technologies (e.g. biotechnology, nanotechnology and ICT) and the promotion of emerging technologies. Providing stakeholders along the entire bioeconomy value chain with the knowledge base and a toolbox that includes a range of key enabling technologies will also be critical to the implementation of a wide range of bioeconomy-related policies. (See Actions 1 and 2)

Several Member States have put in place bioeconomy research programmes and agreed to improve coordination of their research activities through public-public partnering, such as the JPI on "Healthy and Productive Seas and Oceans". Active collaboration between stakeholders

⁷ COM(2011) 809/3

is also needed to encourage more private investment and entrepreneurship in Europe. This includes supporting initiatives to enhance knowledge exchange, simplify European patent law and improve access to public research results, but also the creation of Public-Private Partnerships (PPPs) and the further development of EIPs, such as those on "Agricultural Productivity and Sustainability" and "Raw Materials" (see Actions 1 and 4).

Participative governance and informed dialogue with society

A responsible bioeconomy calls for participatory models that engage citizens and end-users in order to reinforce the relationship between science, society and policy making. More informed dialogues will allow science and innovation to provide a sound basis for policy making and informed societal choices, while taking into account legitimate societal concerns and needs in the bioeconomy.

A large majority of Europeans agree that science and technology will offer more opportunities for future generations. Yet, a significant information gap between science and society still exists. Citizens need to be engaged in an open and informed dialogue throughout the research and innovation process. They need to be provided with reliable insight into the benefits and risks of innovative technologies and existing practices, and more ample opportunities to debate new findings and their implications (see Actions 2 and 5). The EIP on "Agricultural Productivity and Sustainability" will play a crucial role in this respect.

Furthermore, citizens have to be provided with more information about product properties and the impacts of consumption patterns and lifestyle (for instance on the issue of waste), in order to enable responsible and informed choices (see Action 12). Finally, citizens need to be made aware of the opportunities of social innovation and be encouraged to take initiatives.

New infrastructures and instruments

Enhancing a productive and sustainable bioeconomy requires more research, rural, marine and industrial infrastructures, knowledge transfer networks and improved supply chains. Among other objectives, this will support integrated and diversified biorefineries, including small-scale local plants (see Action 10). Petrochemical refinery processes produce a wide range of products, fuels and energy from fossil resources. Biorefineries replace these fossil resources by renewable ones (including wastes), creating new sources of income and jobs for the agriculture, forestry, fisheries and aquaculture sectors. Various funding sources, including private investments, EU rural development or cohesion funds could be utilised to foster the development of sustainable supply chains and facilities (see Action 7).

Bio-based products and bioenergy can be "bio-based versions" of traditional products or novel products with entirely new and innovative functionalities and potential for new and existing markets. To exploit this, the EU is actively driving further development of clear and unambiguous product standards and sustainability criteria at European and international level. These are central for the functioning of the Single Market and the further development of certification and labels that can promote consumer uptake and green public procurement (see Action 11).

2. THE BIOECONOMY ACTION PLAN

The Action Plan below describes the Commission's main actions for the implementation of the Bioeconomy Strategy objectives, building on FP7, Horizon 2020 and other relevant

existing policy initiatives, such as the EIPs. It also invites Member States and stakeholders to engage. A more detailed version of the Action Plan is included in the SWD⁸.

2.1. Investments in research, innovation and skills

1. Ensure substantial EU and national funding as well as private investment and partnering for bioeconomy research and innovation. Develop further JPI and ERA-Net activities in order to strengthen coherence and synergies between public programmes. Support bioclusters and KICs under the EIT for partnering with the private sector. Outline the main research and innovation concepts and priorities for food, sustainable agriculture and forestry and for marine and maritime activities under Horizon 2020.
2. Increase the share of multi-disciplinary and cross-sectoral research and innovation in order to address the complexity and inter-connectedness of societal challenges by improving the existing knowledge-base and developing new technologies. Provide scientific advice for informed policy decisions on benefits and trade-offs of bioeconomy solutions.
3. Promote the uptake and diffusion of innovation in bioeconomy sectors and create further feedback mechanisms on regulations and policy measures where necessary. Expand support to knowledge networks, advisory and business support services, notably through EIPs and bioclusters.
4. Build the human capacity required to support the growth and further integration of bioeconomy sectors by organising university fora for the development of new bioeconomy curricula and vocational training schemes.

2.2. Reinforced policy interaction and stakeholder engagement

5. Create a *Bioeconomy Panel* that will contribute to enhancing synergies and coherence between policies, initiatives and economic sectors related to the bioeconomy at EU level, linking with existing mechanisms (by 2012). Encourage the creation of similar panels at Member State and regional level. Foster participation of researchers, end-users, policy-makers and civil society in an open and informed dialogue throughout the research and innovation process of the bioeconomy. Organise regular *Bioeconomy Stakeholder Conferences*.
6. Establish a *Bioeconomy Observatory* in close collaboration with existing information systems that allows the Commission to regularly assess the progress and impact of the bioeconomy and develop forward-looking and modelling tools (by 2012). Review progress and update the Strategy at mid-term.
7. Support the development of regional and national bioeconomy strategies by providing a mapping of existing research and innovation activities, competence centres and infrastructures in the EU (by 2015). Support strategic discussions with authorities responsible for rural and coastal development and Cohesion Policy⁹ at

⁸ Note: Individual actions may require a separate Impact Assessment.

⁹ COM(2011) 615, Annex IV

local, regional and national level to maximise the impact of existing funding mechanisms.

8. Develop international cooperation on bioeconomy research and innovation to jointly address global challenges, such as food security and climate change, as well as the issue of sustainable biomass supply (from 2012). Seek further synergies between the international cooperation efforts of the EU and Member States and reach out to international organisations.

2.3. Enhancement of markets and competitiveness in bioeconomy

9. Provide the knowledge-base for sustainable intensification of primary production. Improve the understanding of current, potential and future availability and demand of biomass (including agricultural and forestry residues and waste) across sectors, taking into account added value, sustainability, soil fertility and climate mitigation potential. Make these findings available for the development and review of relevant policies. Support the future development of an agreed methodology for the calculation of environmental footprints, e.g. using life cycle assessments (LCAs).
10. Promote the setting up of networks with the required logistics for integrated and diversified biorefineries, demonstration and pilot plants across Europe, including the necessary logistics and supply chains for a cascading use of biomass and waste streams. Start negotiations to establish a research and innovation PPP for bio-based industries at European level (by 2013).
11. Support the expansion of new markets by developing standards and standardised sustainability assessment methodologies for bio-based products and food production systems and supporting scale-up activities. Facilitate green procurement for bio-based products by developing labels, an initial European product information list and specific trainings for public procurers. Contribute to the long-term competitiveness of bioeconomy sectors by putting in place incentives and mutual learning mechanisms for improved resource efficiency.
12. Develop science-based approaches to inform consumers about product properties (e.g. nutritional benefits, production methods and environment sustainability) and to promote a healthy and sustainable lifestyle.