EuropaBio™

POLICY GUIDE

Building a Bio-based Economy for Europe in 2020



LETTER FROM THE CHAIRMAN



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Meeting market demands whilst reducing the impact on our environment is of critical importance to our future on this planet. In order to meet the ambitious objectives set by the European Union and other nations to tackle climate change, we will need to harness all available technologies. Regulation will play a key role in ensuring that new technologies come to market in time to make a difference to reducing our carbon footprint and mitigating the impacts of climate change. We will need some bold regulatory moves.

Biotechnology is a very versatile tool, offering a broad range of techniques applicable to a variety of industries. This technology is helping to improve industrial sustainability by bringing environmental advantages and economic competitiveness – as well as creating new job opportunities. Biotechnology has the potential to contribute to the transformation of our economic model; it is demonstrating that it is the right science at the right time.

Industrial biotechnology can contribute to reducing fossil carbon consumption and global warming in many ways. It is contributing to the development of more environmentally responsible ways to produce materials and fuels. In other fields, biotechnology is already improving the health of our ageing population through a new generation of medical treatments, and making agriculture more competitive and sustainable by creating new non-food markets for crops that are providing alternative economies for farmers.

Europe is at the forefront of industrial biotechnology. With the right policies and focus, Europe should be able to develop and implement a clear strategy for deploying the world's leading bio-based economy by 2020.

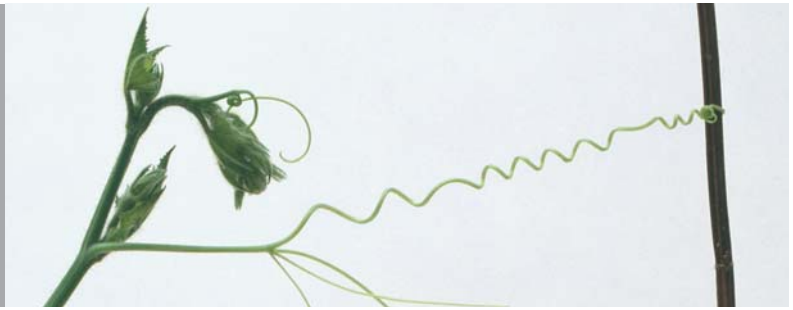
In order to benefit from the full potential of Europe's resources and its academic and industrial capabilities, the Commission and the member states need an integrated and holistic approach to develop a sustainable and competitive bio-based economy. It will be essential to have coherent policy across many sectors, such as climate action, energy security, renewable feedstock supplies, research and innovation, agriculture, the environment, and trade. It will also require the ongoing dedication and commitment of all stakeholders to make it happen.

With this guide, EuropaBio and its members aim to show that if we act together now to seize this opportunity, we can harness the full potential and benefits of biotechnology for the future of Europe, Europeans and the world.

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A BIO-BASED ECONOMY FOR EUROPE

The vision of a society that is far less dependent on fossil fuels for energy and industrial raw materials is closer than ever to becoming a reality in Europe. The application of biotechnology for the sustainable processing and production of chemicals, materials and fuels from biomass creates an opportunity to reduce significantly our dependence on coal, oil and gas. That vision and that opportunity have a name: the bio-based economy.

With its new Europe 2020 strategy, the EU has created a framework through which to achieve an ambitious series of goals – economic, social and environmental – by the end of this decade. The growth of bio-based products opens up diverse pathways towards the achievement of these goals.

Greater use of renewable and expandable resources offers increased potential for cutting greenhouse gas emissions. Production processes that use less water and energy and generate less waste can make industry both more sustainable and more competitive. And the creation of new non-food markets for crops, together with the emergence of alternative income sources for farmers, can give depressed rural areas a new lease of life.

Yet while these opportunities are real, much remains to be done before Europe can benefit fully from the advantages of a competitive bio-based economy. Therefore:

- There must be improved access to renewable raw materials for industrial use, at competitive prices.
- Research must be more targeted, and we must reduce the distance between the laboratory and the marketplace for innovative new products.
- We must use all the tools at our disposal, especially public procurement, to kick-start the market for new bio-based products.

What is industrial biotechnology?

Industrial biotechnology – also known as white biotechnology – uses enzymes and micro-organisms to make bio-based products in sectors as diverse as chemicals, food and feed, detergents, paper and pulp, textiles and bioenergy.

The process works by transforming agricultural products or organic waste (also referred to as renewable raw materials) into other substances, in the same way as crude oil is used as a feedstock in the production of chemicals. In this way, industrial biotechnology can save energy in production processes and lead to significant reductions in greenhouse gas emissions, helping to fight global warming[1]. It can also lead to improved performance and sustainability for industry and higher value products.

Bio-based products already on the market include biopolymer fibres used in both construction and household applications, biodegradable plastics, biofuels, lubricants and industrial enzymes such as those used in detergents or in paper and food processing. Biotechnological processes also constitute a key element in the manufacturing of some antibiotics, vitamins, amino acids and other fine chemicals.



Thanks to biotechnology, renewable feedstock can be used to produce plastic cups, bags, films and textiles



Industrial biotechnology transforms renewable raw materials into biobased products

WHAT IS DRIVING THE MOVE TO A BIO-BASED ECONOMY?

Since the industrial revolution, economic growth has been synonymous with increasing energy use, ever-greater reliance on fossil fuels and accelerating damage to the environment. The more we have produced, the more we have exploited our planet and depleted its resources. We may not yet have broken this cycle, but we are rapidly becoming aware that oil is a resource which is finite and that price will rise over time owing to supply and demand dynamics, especially from developing countries.

The need to cut CO_2 emissions to fight climate change has made the transition from fossil fuels a priority for everyone, industry, decision-makers and consumers alike.

Together with renewable power generation techniques like wind and solar, rapidly developing industrial biotechnology has the potential to be a key tool for the low-carbon emission economy. Because biotechnology is based on renewable resources and bioprocesses are often more efficient, it can lead to significantly reduced carbon emissions. Indeed, a recent report by WWF[2] put the full emissions-cutting potential of biotechnology processes and bio-based products at between 1 billion and 2.5 billion tonnes of CO_2 equivalent per year by 2030 – which would represent more than Germany's total emissions in 1990. The OECD's report[3] on the application of biotechnology to industrial sustainability also confirms its emissions-cutting potential.

In addition, more efficient agricultural practices have led to increased crop yields, stimulating rural development and creating opportunities to develop alternative economies such as the bio-based economy.

Industrial biotechnology has the potential to be a key tool for the low-carbon emission economy



Enzyme-containing washing powders clean clothes at lower temperatures resulting in huge energy savings

THE BIG PICTURE: WHY WE NEED A HOLISTIC APPROACH

Whilst a number of sectoral policies and funding mechanisms have been put in place to support the development of industrial biotechnology and bio-based products in Europe, these exist to an extent in isolation from one another. At EU level, the European Commission's Directorate General (DG) for Research promotes and finances research into industrial biotechnology through the Seventh Framework Programme and the knowledge-based bioeconomy; DG Enterprise's policy unit has selected industrial biotechnology as one of five 'Key Enabling Technologies' it is supporting; and its biotechnology unit is seeking to facilitate the early adoption of new bio-based products as part of the 'Lead Market Initiative'. All of these initiatives are extremely important, but for the moment the whole is not greater than the sum of the parts.

A more integrated, strategic approach is needed if Europe is to get serious about developing a globally competitive bio-based economy within the next decade. Europe has the potential to lead the world in transitioning to an economic model which uses renewable resources not only for energy production but also for industrial sectors like chemicals and materials. Such a goal would be fully in line with the aims of both the European Economic Recovery Plan and the new Europe 2020 agenda. But while it is achievable, it is also hugely ambitious – which is why it demands a holistic strategy involving both the European Commission and EU member states, as well as key players in industry and academia.

A holistic approach is all the more urgent since the bio-based economy will need a supportive policy framework in numerous areas. These include climate change, energy security, renewable feedstock supplies, research and innovation, agriculture, the environment and trade.



Biomass can be used to produce plastic for cups, bags, films and textiles

A more integrated, strategic approach is needed if Europe is to get serious about developing a globally competitive bio-based economy within the next decade

KEY PRIORITIES AND ACTIONS

An integrated strategy should be pragmatic, focused on the long term and open to partnerships with public and private sector players both in the EU and elsewhere. It should include five aims:

1. Improving and securing access to renewable raw materials for industrial use.

2. Supporting targeted research, training and innovation programmes with clear objectives.

3. Developing technologies and bridging the gap between research and the market.

4. Stimulating market demand for bio-based products in Europe and around the world.

5. Improving awareness via efficient communication and education.

A holistic, integrated EU strategy for the development of a bio-based economy will accelerate progress towards the more sustainable growth model Europeans are calling for, with all of the financial, ecological and social opportunities that will bring.



Agricultural waste is increasingly used as feedstock in the production of biobased products such as biofuels

Secure access to sustainable renewable feedstock

Today's oil-reliant economy has, for the most part, no difficulty in obtaining what it needs to function: the supply of crude oil is adequate and relatively constant, with prices generally driven by demand. This is not always the case for agricultural commodities. Supply is less predictable and as a consequence, prices can be more volatile.

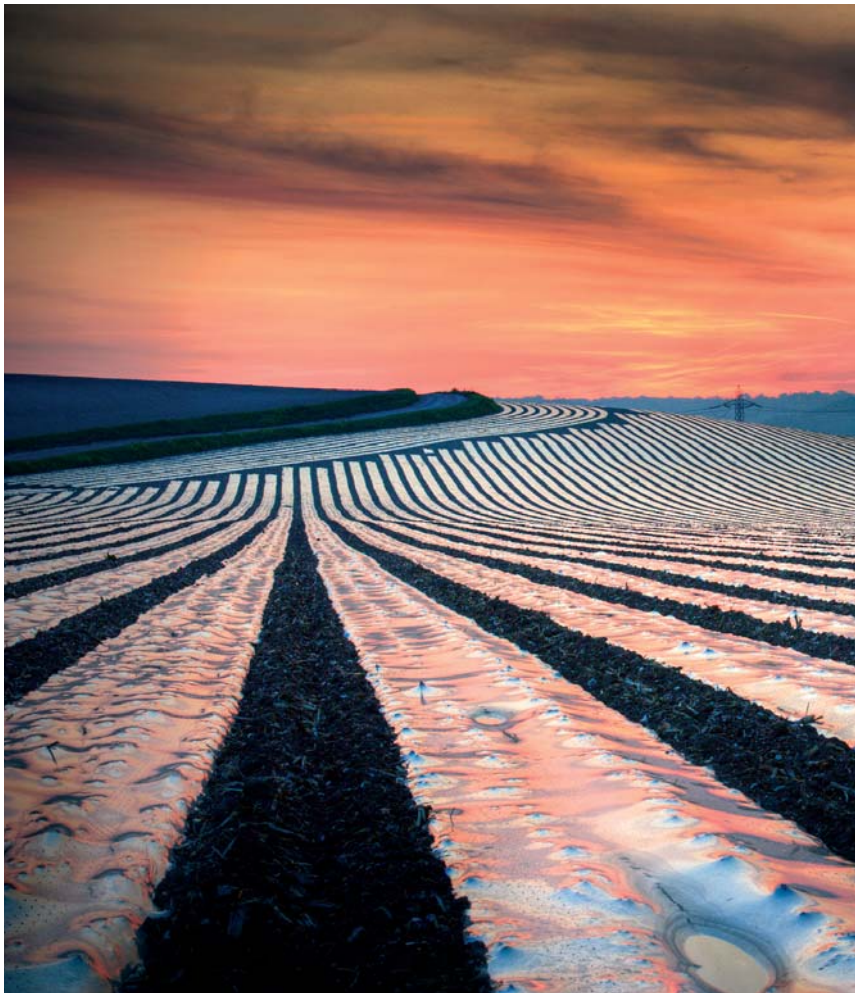
Yet if Europe is to develop a robust bio-based economy, it will require access to renewable feedstock in sufficient quantities, of guaranteed quality and at a competitive price. This must of course also be achieved without disrupting food supply. Germany's Nova Institut[4] estimates that 500 million hectares of land are available worldwide for sustainable biomass production that does not require deforestation or the use of artificial irrigation.

In the EU, bio-based feedstock production is heavily regulated by the Common Agricultural Policy. This makes it more difficult to reconcile demand with competitively priced supply and risks slowing the evolution of the bio-based economy. Furthermore, the EU's newer member states continue to suffer from much lower agricultural productivity than is the norm in the EU-15. And we are entering an era in which agriculture as a whole will need to find new ways to increase yields in the face of climate change, reduced soil quality and unpredictable growing conditions.

To ensure a plentiful, reliable supply of affordable biomass feedstock, Europe requires supportive programmes. If the market for bio-based products is to develop, the establishment of efficient, cost-effective supply chains, providing raw materials of known and consistent quality will be essential.

Recommendations

- Devise policies that improve land productivity and land management in a sustainable way.
  - Develop ligno-cellulosic and energy crops alongside traditional ones.
  - Improve the cropping system to mobilize existing biomass and make land use more efficient.
  - Encourage the growth of perennial crops to make the most of underutilized land through reform of the Common Agricultural Policy.
- Adapt the EU farm policies to promote the production of renewable raw materials for all industrial uses.
  - National rural development plans should include actions to stimulate the production of renewable raw materials for industrial use.
- Explore the use of green biotechnologies especially for industrial applications in order to improve European agricultural competitiveness.
- Develop and implement sustainability criteria for biomass consistently and independently from the field of use (such as food, biobased products, biofuel and bioenergy) to create a level playing field.
- Invest in local and regional infrastructures and logistical capabilities to allow all biomass, including agricultural, forestry and waste-based raw material, to be utilised.



Biobased films are crucial for maintaining and improving agricultural productivity



Supporting more targeted research and innovation

Research related to industrial biotechnology and bio-based products in Europe today is funded from three principal sources: individual companies, the EU and its member states. Funding from the EU budget is channelled primarily through the Seventh Framework Programme, which supports projects carried out by consortia of partners in multiple countries. Funding from the member states is largely sourced from regional and/or national research councils, with several countries now coordinating their efforts through the EU's ERA-Net for Industrial Biotechnology[5].

To ensure that research funding is spent as efficiently and effectively as possible, the EU should take the lead in designing a coordinated Europe-wide research programme for industrial biotechnology and bio-based products. This should include financial support for relevant research, education and international initiatives aimed at removing bottlenecks and obstructions to the emergence of a European bioeconomy.

Crucially, such a programme should cover the entire value chain of the bio-based economy: plant engineering, crop harvesting and local processing, logistics, pre-treatment in the biorefinery, enzymes, fermentation organisms, secondary manufacturing, compounding, side-product valorisation and product recovery. It should also extend to the supply side, with research to improve the yield and sustainability of new crops for raw materials supply.

One of the key benefits of an overarching European research programme would be to share the risks inherent in developing innovative bio-based products. By supporting pre-competitive research covering the entire value chain – from crop to bio-based product – the programme will facilitate innovation in the sector and encourage the uptake of its results by the industrial partners involved.

Recommendations

- Launch a coordinated Europe-wide research programme for industrial biotechnology and bio-based products - covering the entire value chain - via public-private partnerships.
- Emphasis should also be given to the end of the value chain (new end-product applications) as one of the industry's major challenges is to translate research to products.
- Coordinate member state research programmes via ERA-nets (e.g. the ERA-net for industrial biotechnology).
- Develop specific funding for translational research.
- Set up grants for "Proof of Concept" studies (especially for SMEs).

Building the bridge between research and market

For some time now it has been clear that Europe's relatively poor record on innovation is due only in part to its not spending a sufficiently high percentage of GDP on research and development. Though this is a factor, a bigger problem is that we take too long to transform research results into innovative, marketable products. Indeed, much of the knowledge resulting from European research leads to the commercialisation of products by European companies in other parts of the world.

A key reason for this is that it is difficult to access public money for public-private partnerships and for demonstration projects in Europe. Addressing this must be treated as a priority if the EU is to move beyond a situation in which the benefits of research carried out here are felt predominantly through the roll-out of innovative technologies elsewhere.

Ambitious demonstration programmes with significant amounts of funding in other parts of the world, such as the United States, have already attracted many European companies in this way.



Enzymes are used to make millions of pairs of stonewashed jeans each year, making huge energy savings

Recommendations

- Facilitate access to flexible, research-orientated pilot plants.

  - Enable companies to use pilot infrastructures during the research and development stage to test and refine industrial processes, reducing lead time and investment costs.

- Close a critical gap between scientific feasibility and industrial application through demonstration activities, allowing companies to gain a better understanding of actual operating costs and the strengths and weaknesses of technological processes.

  - Increase public funding for demonstration projects, prior to industrial scale-up.

  - Provide state support to minimise the financial risks inherent in researching and developing new technologies, products and partnerships.

  - Use national and EU funds, as well as European Investment Bank loans, to facilitate public-private partnerships for the setting up of demonstration projects[6].

  - Develop public-private funding schemes for multi-company consortia to build innovative demonstration-scale biorefineries.

- Develop specific funding schemes for pioneering bioproduction facilities and encourage the formation of coalitions of companies active in all parts of the value chain to build small-scale projects and create integrated solutions.

Stimulating market demand

Europe is well-placed to become a world leader in the market for innovative bio-based products, building on its strong technological and industrial position in the field. Yet perceived uncertainty about the properties of these products is for now hindering their uptake.

The European Commission's Lead Market Initiative for bio-based products[7] is a good example of a synchronised approach to stimulating demand for these innovative new products. It should be further developed and built upon.



Innovative bioprocesses can produce isoprene from renewable raw materials, which is used to manufacture tyres

Recommendations

To effectively implement LMI recommendations:

- The biological/biobased carbon contained in biobased products shall be deducted in the calculation of the total CO_2 equivalent emissions of the products[8].
- We must consider setting indicative or binding targets for certain bio-based product categories, drawing on the experience from biofuel quotas in the EU.
- We must allow Member States to reduce taxes for sustainable bio-based product categories.
- We should encourage contracting authorities in all EU Member States to give preference to bio-based products in tender specifications. A requirement or a recommendation to give preference can be laid down in a national action plan adopted by the government. Preference should be given to bio-based products unless the products are not readily available on the market, the products are available only at excessive cost, or the products do not have an acceptable performance.
- We should develop clear and unambiguous European and international standards. The standards will help to verify claims about bio-based products in the future (e.g. bio-degradability, bio-based content, renewable carbon, recyclability, and sustainability).
- The sustainability assessment should be based on all three pillars of sustainability: environmental, social and economic. While we need to develop tools to assess sustainability of products, we need to ensure the tools used will stimulate and not limit the development and implementation of bio-based products.



Biotechnology produces more environmentally friendly dyes for the textile industry

Education and communication

Although industrial biotechnology is one of the key enabling technologies necessary to secure a sustainable future for European society, there is still a lack of awareness within the manufacturing industry, among policy makers, consumers and even investors. To facilitate smooth long-term development and implementation of a bio-based economy, a strategy for communication and stakeholder involvement is necessary not only to raise awareness and provide information, but also to reflect upon long-term developments and applications from the different perspectives.

Stakeholders' awareness requires the demonstration of the benefits of the technologies via concrete examples. An appropriate coordinated communication strategy, together with a series of round-tables with a broad stakeholder base to put technological developments and implementation in perspective, is a must.

In addition, due to a gap in education, biotechnology and chemistry are still too often perceived as "competing technologies" instead of as being complementary.

Recommendations

- Improve awareness of the benefits of industrial biotechnology and bio-based products with investors, industry, consumers, policy makers via dedicated communication programmes.
- Improve social acceptance of industrial biotechnology. The problems with the acceptance of green biotechnology, especially in Europe, could have an indirect impact on the bio-based economy, as well as more recent public discussions on "indirect land use changes" such as food versus fuel.
- Taking up industrial biotechnology in education.

CONCLUSION

Industrial biotechnology offers Europe the potential to accelerate its transition to a more sustainable growth model while developing a high-value, globally competitive sector capable of generating good quality jobs, in rural as well as urban settings. It is, in short, perfectly in synch with the strategic priorities set out in the new Europe 2020 programme.

To take advantage of this opportunity, the EU must develop a holistic, integrated strategy to make the bio-based economy a reality. There must be consistency and coherence across policies and product sectors, coupled with the political impetus to ensure that this goal is treated as a priority.

The arguments in favour of industrial biotechnology and bio-based products are persuasive and will only become more so with the growing urgency of tackling the twin threats of climate change and energy insecurity. European companies are well-placed to turn this opportunity offered by this confluence of factors. The potential benefits – economic, social and environmental – are significant. It is up to policymakers to design the legislative and regulatory framework needed to make a European bio-based economy a reality. And it is in everyone's interests for them to do so sooner rather than later.

REFERENCES

1. *How industrial biotech can tackle climate change (EuropaBio, 2009)*

2. *'Biotechnology – more than green fuel in a dirty economy?' (WWF, 2009)*

3. *'The application of biotechnology to industrial sustainability' (OECD, 2001)*

4. *See http://www.nova-institut.de*

5. *See http://www.era-ib.net*

6. *Many European companies are already participating in demonstration projects in the US funded through public-private partnerships. For instance, on May 5 2009 the US Department of Energy announced plans to allocate $786.5 billion from the American Recovery and Reinvestment Act as additional funding for commercial-scale biorefinery demonstration projects. Similar investments are being made in China and Brazil.*

7. *Taking bio-based from promise to market: measures to promote the market introduction of innovative bio-based products (European Commission, 2009)*

8. *A study by scientists at the University of Utrecht claims that the use of existing renewable feedstock in the production of bulk chemicals could reduce consumption of energy from non-renewable sources, as well as carbon emissions. The study predicts that the use of 'green' chemicals made in biorefineries could result in a reduction of global emissions by one billion tonnes.*

See: "Producing Bio-Based Bulk Chemicals Using Industrial Biotechnology Saves Energy and Combats Climate Change" - B. G. Hermann, K. Blok, and M. K. Patel - Environ. Sci. Technol., 2007, 41 (22), pp 7915–7921

EuropaBio's mission is to promote an innovative and dynamic biotechnology-based industry in Europe.

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