



European
Commission

EU Bioeconomy Policy day

Report of the Rapporteurs on workshops held
on 16th November 2017

discussing the outcomes of the EU 2012
Bioeconomy Strategy review and how to move
the bioeconomy forward

Title of the publication

European Commission
Directorate-General for Research and Innovation
Directorate F — Bioeconomy
Unit F.1 — Strategy
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Manuscript completed in 2018.

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Luxembourg: Publications Office of the European Union, 2018

Print	ISBN 978-92-79-80330-7	doi:10.2777/2878	KI-02-18-238-EN-C
PDF	ISBN 978-92-79-80331-4	doi:10.2777/248680	KI-02-18-238-EN-N

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INTRODUCTION

On the 16th November 2016 the European Commission organized a high level Bioeconomy Policy event to discuss the progress on the delivery of the European Union's *Bioeconomy Strategy and Action Plan, adopted in February 2012*. The event began with an introduction on why the Strategy was needed, what it covered and the progress that had been made on its delivery. This was followed by nine parallel sessions organised by nine Directorates General, some of which co-signatories of the 2012 Bioeconomy strategy, that discussed the role of the relevance of the Bioeconomy to each of the Directorate General's, example of what had been done and outlined the key actions that are needed in making further progress towards a sustainable, more circular EU Bioeconomy.

This report highlights the discussion in each of the sessions, describes briefly any relevant projects mentioned, discusses the importance of EU policies in shaping the Bioeconomy revision and highlights any particular issues during the sessions. It also outlines answers to 2 specific questions that were put forward for discussion at each session:

- *What is the relevance of the EU bioeconomy in your point of view?*
- *What actions are needed in making further progress towards a sustainable, circular (EU) bioeconomy?*

The structure of the report for each session reflects how the session was run by the moderator.

1 Parallel Policy Sessions on rural area, smart specialization, food waste.

1.1 Innovation in the bioeconomy: new opportunities for rural areas

The Moderator, Dr Calliope Panoutsou (Imperial College, London, UK), introduced the session and the speakers, emphasising the focus on agriculture, rural communities and forestry.

The first presentation was by Director Pierre Bascou from DG AGRI who emphasised the crucial role agriculture and forestry plays in the bioeconomy, calling it the backbone of the bioeconomy. It produces not only the quality food for humans and feed for animals, but also the feedstock for chemicals and novel compounds. Agriculture and food makes up three quarters of the existing jobs in the bioeconomy and two thirds of its turnover.

Key points from his presentation included:

1. There needs to be support for monitoring the bioeconomy and coherence in public policy to support the bioeconomy.
2. Going forward it will be important to take into account the impact of new technologies such as Artificial Intelligence, robotics, "big data" to grow jobs and promote growth.
3. Farmers and foresters have a key role to play and it is fundamental that they are involved in the process as an active stakeholder in the whole supply chain, and not only as passive supplier of biomass. For example, also taking part in the distribution of the value added and the knowledge creation. They also need to learn new skills and expertise to deliver sustainable biomass use and play their role in the bioeconomy sustainably.

The second presentation was given by Bill Morrissey Procurement Manager from Glanbia, a large dairy cooperative company based in Ireland. He emphasised the importance of the bioeconomy to Glanbia's strategy, which is one of adding value in novel ways to milk and dairy by-products. In this way Glanbia aims at maximising profit for its members, which are dairy producers.

Dr Panoutsou then introduced the additional panel members: Oana Neagu (Director COPA-COGECA), Lena Bruce (European State Forest Association (EUSTAFOR)) and Davy Liger (Head of Office in charge of the Bioeconomy at the French Agricultural Ministry). Dr Panoutsou posed an introductory question, (outlined in italics below) to each of the panel members (a summary of the answer is provided below):

To Oana Neagu: *We speak very often about the potential benefits of the bioeconomy for farmers. Does the agricultural sector share this positive view? What do farmers expect from the bioeconomy?*

Oana Neagu: Bioeconomy has been endorsed by farmers and our association as very important but it takes time to reach implementation and see concrete activities. There is strong need: a) for research and innovation; b) to improve networking to communicate benefits, best practice examples and build added value; c) for consistency and continuity of financial support that is tailored to farmers' needs. We therefore need to continue working together and ensure that appropriate mechanisms are in place for farmers.

To Bill Morrissey: *The business model you have presented is a good example of how farmers can go beyond a role of biomass suppliers, and capture a share of the biorefinery added value. What are the baseline conditions so that this model can be replicated in other places and sectors?*

Bill Morrissey: The baseline conditions for such business models are: innovation, communication and education.

To Lena Bruce: *How can state forests specifically contribute to bioeconomy sustainability? What are their strengths?*

Lena Bruce: State forests organisations must extend their knowledge for conventional forestry, improve their practices and maximize the added value from their products. Full transparency is required for the origin and quality of end products and this can only be achieved through sustainability, standardisation and certification. Forests can have the role of 'test beds' for new and innovative pathways and become the engine for research and innovation in the bioeconomy.

To Davy Liger: *What can public authorities do to ensure that smaller players, i.e. farmers and forest owners, benefit from the bioeconomy? '*

Davy Liger: Farmers and forest owners need to know the issues for contributing to the bioeconomy and the requirements of downstream processes so that they can make efficient contributions.

There is a real need for a shared vision and systemic strategy including farmers and forest owners at national and local level. For example the French strategy was adopted in January after two years of discussions with all stakeholders.

It is also important to have a dialogue between upstream and downstream operators. Public authorities can manage this dialogue. He provided the example of hemp producers making products for the car industry.

It is important to encourage official communication with the general public, including debate concerning potential conflicts between food and non-food uses. Public authorities should also consider investment in innovation to help farmers to produce more and better, perhaps supported by financial support and administrative facilities (e.g. to encourage the construction of biogas plants).

Two questions were posed to the session panel member that provoked some debate between the panel and the audience and generated the following points:

Question 1: *What is the relevance of the EU Bioeconomy in your view and how to maximise the benefits of the bioeconomy for the rural areas?*

1. Go beyond research and innovation: establish policies with consistent messages and interlinkages to all sectors involved.

2. Farmers need the 'right' support and so far the available financing tools cannot fully support the development of bioeconomy. Financial support is required in many Member States to provide infrastructures needed for the bioeconomy e.g. fast broadband etc.

3. There is a need to raise awareness and connect people with the bioeconomy.
4. Farmers and foresters are central to developing the bioeconomy which is a significant opportunity for them. It needs investment and time to develop the new supply chains for the bioeconomy.
5. It provides a good way of bringing in new thinking, new technology and new people into the sector, helping farmers and foresters diversify and grow jobs. It can also build much needed financial security for the rural communities.
6. Help people understand the value of biomass that is currently considered as waste and discarded.
7. It is important to drive innovation, particularly in rural communities.
8. It could prove an important vehicle for valuing and improving ecosystem services and building it into relevant business cases.

Question 2: *What actions are needed, for example for primary producers, industry and governments in making further progress towards a sustainable, circular EU bioeconomy?*

1. Ensure public procurement actions endorsing biobased products. A big challenge for respective procurement officers is the relatively high cost of such biobased products as compared to conventional ones, while they have to select 'least costly' solutions/products. For example, how could more construction in wood be encouraged?
2. Only national bioeconomy strategies are not enough; every region should have its own bioeconomy strategy and build actions around local biomass sources and capacities (human and infrastructure).
3. Coherence in policy towards the bioeconomy is necessary to grow all the potential new markets in renewable energy, waste, agrichemicals, food etc.
4. Drive new technologies that help deliver the bioeconomy and deliver benefits to rural communities e.g. via robotics, artificial intelligence, big data management and novel biological processing.
5. Build the skills of the existing rural workforce so that they can take advantage of the new opportunities in the bioeconomy.
6. Co-operation is really important to deliver the change needed towards a sustainable bioeconomy.

7. It is really important to stimulate investment in the underpinning infrastructures needed for the bioeconomy. Part of this might be involving ways of reducing risk for banks to encourage investment.
8. There is a need to incorporate ecosystems services into the bioeconomy thinking and work out ways of paying for its maintenance and improvement.
9. Encourage biomass production for food and non-food. This is key.
10. When developing national strategies it will be worth mapping feedstocks, against existing technologies and making clear what might be available for new technologies.
11. Support the development of technologies by helping to scale up to demonstration scale.
12. Communicate the benefits of the bioeconomy to citizens, investors, the public sector and to businesses.
13. When promoting new business models, these should be inclusive and fairly reward all actors in the supply chain e.g. farmers and foresters.
14. Going forward it will be critical to link the Circular Economy and the bioeconomy more intimately and think systemically from primary production, through to the citizen and then "closing the loop" returning nutrients back to the soil. This could prove a crucial paradigm for the future. It is about driving a Bioeconomy Revolution.

1.2 Bioeconomy and Smart Specialisation in Regions

This session was moderated by Katja Reppel (Deputy Head of Unit- Smart & Sustainable Growth, DG-Regio). Ms Reppel introduced the programme with a talk about the importance of smart specialisation in delivering innovation priorities, incl. bioeconomy. She also emphasised cohesion policy's opportunities for building facilities that can help businesses scale up their new bioeconomy products. This allows sufficient product to be produced for testing purposes and to provide costs and technical information that makes the new businesses "investor ready". Having these demonstration facilities close to networks of small businesses and universities that attempt to commercialise their ideas, also helps substantially.

Ms Reppel then introduced a wide ranging presentation by Daniele Colombo, technical co-ordinator of the Bioeconomy Pilot of the Vanguard Initiative. This initiative is running 7 diverse projects, working with regions across Europe, specifically on:

- Lignocellulose refinery to produce “green building blocks” for the chemical industry
- Bio-aromatics (has a similar aim to the above refinery)
- Turning (waste)gas into value
- Biogas Beyond Energy Production
- Bio-Aviation Fuel
- Food & Feed Ingredients from Agrofood Waste
- Food & Feed Ingredients from Algae

He discussed the benefits of collaboration, within and between regions, the importance of piloting and demonstration, the development of clusters of SMEs working in similar areas that learn from each other, share expertise and help nurture the businesses.

There was then a discussion by the panel consisting of Mr Colombo, Lieve Hoflack (Project manager from Bio-Base Europe) and Antoine Peeters (Head of Department of IAR- a French Bioeconomy Cluster), led by Katja Reppel. The discussion initially focused on the experience of the panel in delivering the smart specialisation in the European regions and then moved onto considering the 2 questions on the bioeconomy. The main points are listed below.

Question 1: What is the relevance of the EU bioeconomy in your point of view?

1. It helps set up new, innovative and sustainable supply chains which inherently make the best use of resources.
2. It drives innovation in business both regionally, nationally and across Europe.
3. It is relevant to food and non-food sectors such as construction, textiles and chemicals.
4. It can foster collaboration between businesses, universities and investors which encourage more rapid development and growth of new businesses.

Question 2: What actions are needed in making further progress towards a sustainable, circular EU Bioeconomy?

1. Support the scaling up of new ideas from lab stage in universities and SMEs to full scale production through pilots and demonstration scale efforts.

2. Communicate the benefits of the bioeconomy to citizens, public authorities and existing supply chains and take the time to build resilient supply chains.
3. Interregional collaboration can be key to driving change and support the formation of bioeconomy clusters of universities, SMEs nearby to demonstration scale activities.
4. Consider existing supply chains and consider how the bioeconomy could transform them with novel approaches.
5. Build a shared vision for the sustainable circular bioeconomy, supported by an appropriate legal framework, which drives systemic change. Encourage leadership across the EU at national, regional and local level.

1.3 Practice of food waste prevention as implementation of policy of circular economy

Aminda Leigh (AMROS media solutions) introduced the session with a presentation from Anne-Laure Gassin (DG-SANTE) on the EC's policy on food waste, the work of the EU-Platform on food waste and the EU's draft Circular Economy package.

This was followed by a presentation from Paul Featherstone (European Former Foodstuff Processors Association) on the new possibilities of diverting former foodstuffs and by-products to animal or fish feed, therefore "closing the loop", and reducing the environmental impact of meat and fish production. He emphasised the critical importance of traceability and food safety right across the feed supply chain to minimise the risk of disease transfer and the controls that were in place to ensure this happens. He emphasised the scale of the industry and its scope for growth. He also suggested where regulatory change may help the industry deliver more benefits safely.

Jolanda Soons-Dings from Lamb Weston and the European Potato Processing Association (EUPPA) presented on how to reduce food waste across the supply chain. She showed analysis of potato loss and waste across the supply chain. She then showed what was being done to reduce this waste and to make best use of any waste that does arise, in order to maximise value and deliver more circularity. She also highlighted particular barriers to making more effective use of wastes e.g. the stringent rules on growing insects on wastes and by-products that could then be used as feed for chickens for example.

Finally Dr Erica van Herpen (Wageningen University) spoke about new insights into consumer behaviour that leads to food waste in the home and how this might be deployed in consumer campaigns. Her main conclusion was that raising awareness of the issue and scale of food waste is simply not enough. It doesn't help people to change, they need motivation, they

need to know how to make the change, the context for the change (i.e in planning to shop- make a list) and critically the benefits of the change in a language most relevant to them. Also it is most important to test interventions and see what impact they have as it will help build up a thorough understanding of what works with citizens.

Toine Timmermans (Wageningen University) then joined the panel and they answered questions from the audience and the questions posed for the session. The answers given are outlined below:

Question 1: *What is the relevance of the EU Bioeconomy in your point of view?*

1. Creating much more value from natural resources that are currently wasted.
2. The bioeconomy strategy sets out clear direction and a plan of action while ensuring both food security and food safety.
3. Important to “getting more outputs with less inputs” and stimulate innovative thinking to improve business efficiency and reduce environmental impact.
4. It has strong links to the UN Sustainable Development Goal 12 and critical to driving change to build a more sustainable food system.

Question 2: *What actions are needed in making further progress towards a sustainable, circular economy?*

1. Change regulation to allow former foodstuffs to be used to grow insects for sale as animal feed or to produce fine chemicals where it is safe to do so.
2. Don't create barriers to innovation by subsidising competing technologies e.g. Anaerobic Digestion (AD).
3. Measurement and mapping of potential feedstocks for the bioeconomy is needed as well as monitoring the impact of change.
4. Creating the best regulatory environment to help make the best use of resources.
5. Fostering collaboration is key to driving change particularly given the system change we are targeting.
6. Motivate citizens to learn improved food skills by providing advice and encouragement in the right context.
7. Encourage joined up thinking across the DG's to deliver policy coherence.

8. Always follow the science in delivering on the bioeconomy - not the prevailing political view.

9. What role might payment for waste collection have in driving change in the home?

10. How to integrate helping people eat more healthily and sustainably into the bioeconomy narrative.

1.4 Conclusion from the rural area, smart specialization, food waste policy sessions

From the three sessions, there was a lot of commonality in feedback on the two key questions. Below is the synthesis of the feedback to each of the two key questions.

Question 1 – ‘what is the relevance of the bioeconomy?’

The answers fell into three categories:

- Relevance to people and their potential
- Relevance to prosperity
- Relevance to the planet

On **people** and their **potential** - it’s about helping people and businesses build new sustainable bioeconomy approaches and develop the skills and expertise needed to deliver. The beauty of the bioeconomy is that it operates across Europe: in rural communities and in towns and cities and therefore, has huge potential.

On **prosperity** – it’s about driving sustainable growth and making much more effective use of our natural resources – growing jobs and adding value. At its heart, it’s getting new innovations effectively to market.

On the **planet** – sustainability and circularity are seen as being at the core of bioeconomy. There was also a strong desire for the bioeconomy to improve biodiversity and strengthen ecosystem services. This is an extension of what is often seen as the role of the bioeconomy and an important thought to build on.

Question 2 – ‘what are the actions needed in making further progress towards a sustainable EU bioeconomy?’

Five themes stood out from the sessions:

Developing relevant new policies and delivering policy coherence across Europe.

Easy to say, really hard to do. Many speakers felt though that this is key to delivering the vision for the bioeconomy. For example, how to encourage the best use of waste resources, and how to ensure that the provision of ecosystem services is valued, improved and appropriately funded.

Nurturing innovation and promoting cooperation across regions and supply chains.

This is not only about support for research and development, but it also needs piloting and scale up. Delivering the bioeconomy requires new supply chains and changing existing chains – this, critically needs collaboration. It also requires a systemic approach as it is about system change.

Building critical infrastructure

This includes everything from rural broadband, so new technology can get used in farm and forestry, to facilities that can allow production scale up. It is about building investor confidence, it is about regular measurement of change, and it is about mapping feedstocks.

Providing relevant education and skills

This is critical to ensuring that as many people as possible can be part of this revolution.

Underpinned by great communication.

Communication on the potential of the bioeconomy; its benefits and what is already being delivered. Critically, it is about building momentum towards delivering a more sustainable bioeconomy for the benefit of Europe's citizens, Europe's economy and Europe's environment.

2 Parallel Policy Sessions on climate benefits, Bioeconomy ecosystems, Bioeconomy indicators.

2.1 Ecosystems as the productive basis of the bioeconomy – health, resilience and productivity

Moderator: Humberto Delgado Rosa, Director, DG Environment.

Bioeconomy has potential to make us less dependent on non-renewable resources and fossil fuels. New technologies help to create new products from biomass. Biomass comes from ecosystems, but according to the UN report, 60% of the global ecosystem services are degraded or used unsustainably. We have gone too far in biodiversity loss already and we do not have a proper nutrients cycle. Unfortunately, we are not efficient in our use of resources, but the good news is that we have ample room to improve efficiency, thus getting more use out of biomass without increasing

impacts. Society is more aware of the value of ecosystem services than previously which can bring more sustainability.

First speaker: Prem S. Bindraban, director of European-Netherlands office IFDC

Nutrients are food for plants. In natural conditions a hectare of land will deliver 1 ton of grain, when applying nutrients this can go up to 10 tons per hectare. Fertilizers are needed to ensure food security, but current and future use of nitrogen and phosphorus exceeds our planetary boundaries jeopardizing biodiversity, climate and water quality. On the other hand, nutrients are lacking especially on the African continent to raise yields. They include not only nitrogen and phosphate, but also micronutrients. In current fertilizer industry there is too little innovation. More and different types of innovative fertilizers are needed. We could be a lot smarter in the type of fertilizer and how to use them. To do this we need fertilizer design, driven by life supporting biology. Although it is not easy, it is possible to remain within our planetary boundaries. Current fertilizers however will not deliver that, certainly not to also support biomass production for non-food purposes.

Second speaker: Prof. Dr. Helmut Haberl, Director, Institute of social Ecology Vienna (SEC), Alpen-Adria Universitaet (AAU).

In the past century, the global human appropriation of biomass production on land grew from 13 % to 25 % of total potential net primary production (NPP). Humans already use 75 % of available land. The rest is desert and arctic land which cannot be used for production or are rainforests that we want to protect. Urban expansion until 2030 will consume 3-4 % global crop production, because urbanization uses the most fertile land. We need to optimize the use of space to feed the world. Which diets will be adopted plays a crucial role for the global land system. An analysis of the future option space shows that land availability for bio-energy depends on production and diets. If we have high yields and vegan diets, there will be high bioenergy potentials. With high yields and rich diets this extra production is not available. Large potential of unused land waiting for planting energy crops should not be expected. Increasing demand of land-based products will increase pressure towards intensification and land-use competition. Using residues will affect the carbon balance of agricultural land, if too much biomass is removed from croplands.

Third speaker: Marta Santamaria, technical Director, Natural Capital Coalition.

The Natural Capital coalition developed the Natural Capital Protocol, a standardized framework to mainstream natural capital into decision making. The protocol was launched in July 2016 and there are already 35.000 copies in circulation. The Coalition integrates 270 organizations with representatives from all parts of the society. Already in the first year more

than 100 companies participated in the Protocol Application Program and there is a growing number of case studies shared in the Natural Capital Coalition HUB. The Protocol framework consists on replying to four basic questions faced by decision makers: 1) Why is natural capital important? 2) What should we consider when we assess natural capital? 3) How are we going to measure and value impacts and dependencies on natural capital? 4) What decisions we are going to make?

Using a natural capital approach has three contributions: (i) assessing not only impacts but also dependencies on natural capital across the whole value chain; (ii) moving from just measuring in physical terms to also valuing as a way to understand the relative importance of impacts and dependencies; and (iii) moving from assessing separate issues to considering a system thinking approach. Under the Natural Capital Protocol there are a number of Sector Guides, such as the Food & Beverage Sector Guide; Apparel Sector Guide; and Forest Products Sector Guide. A number of Supplements are coming up, such as the Oceans, Biodiversity; Data and Finance Sector Supplement.

Fourth speaker: Sini Erajaa, EU Bioenergy Policy Officer, Birdlife Europe.

We are already in the bioeconomy, if you want to know how it is working and what its impacts are then look around and see it and see its current impacts. Some crucial things that we are seeing: the EU has an heavy ecological footprint twice as big as the biocapacity of our continent so we are heavily overconsuming our natural resources around us including the natural renewable ones, the insect biomass decreased by 75 %, on the forest side the sequestration capacity of our forests is to absorb CO₂ from the atmosphere is declining. Although Birdlife signed the Bioeconomy Manifesto, it is still critical how the bioeconomy will be implemented sustainably. That is about resource use, protect biodiversity, land rights, human rights and food-fuel discussion. The hierarchy of actions is: reduction of consumption, better management of already managed ecosystems and better use of resources. The Circular Economy Action Plan including Waste Legislation is a crucial part of bioeconomy. What reform of the Common Agricultural Policy can deliver in environmental problems? We need to fully implement the nature legislation and have more protected areas and limits to biomass use in energy production.

Discussion:

Stakeholders pointed out that we should not ignore all the efforts already made by the agricultural sector. European agriculture is leading on sustainability in the world. We should also recognize the burden and pressure on the farming sector by many rules and regulations. If we want to have food that is produced in Europe we have to think about all these elements. Why are we only thinking of terrestrial food production and forget blue biomass?

It is important to have sustainable production in Europe, but we are already importing a lot. We also need to watch out for the impacts in other parts of the globe. The burden of food production must not be on farmers only, but for instance also on the fertilizer industry that uses 100 years old innovations. We want to see robust, measured information and valuation of what we want to promote by the Bioeconomy Strategy. We do already many things well and we have opportunities. We have to show that we are doing things better and prove it by information and measurement. The role of ecosystems needs to be integrated by concrete actions.

2.2 Climate benefits of the bioeconomy

Moderator: Ana-Kaisa Itkonen, Commission Spokesperson for Climate action and Energy

First speaker: Bart Muys, professor of forest ecology and management at K.U. Leuven, Faculty of Bioscience Engineering.

The bioeconomy is not new, it already existed in the 19th century before the fossil economy. It had sometimes sustainability problems like poverty, land degradation, and biodiversity loss. Bioeconomy has a potential to be sustainable, but it is not by default. It has to operate within the natural boundaries of the planet. Bioeconomy should also become circular and ecosystem services should be included. The basis of bioeconomy is sustainable yield. We should not extract more than can grow back. In forestry a management control is needed. It would be good if there would be a stress-test for forestry.

To measure the climate effect we should use time and space integrated Life Cycle Assessment (TiSpa LCA). Forests are important not only for the carbon cycle but also for the global water cycle.

Second speaker: Daniel Zimmer, Climate- KIC: the role of Bioeconomy and innovation in addressing Climate Change.

Two main points:

1. To defossilize the economy, biobased materials are very much needed, but mostly overlooked.
2. There is a substitution needed to more organic carbon. The current approach is too narrow. Also the downstream substitution effects need to be calculated. When comparing substitution effect, be aware of difference in life time. Circularity is important, because it increases the lifetime of material.

Third speaker: Emma Berglund, secretary general CEPF, Confederation of European forest owners: Bioeconomy growth and sustainable forest management: opportunities for forest owners.

To ensure sustainable use of the forest, there are already instruments like 70% of European forests are under management plan or similar and 55-65% of forests are certified. There is national and EU legislation in place. Furthermore there are very active forest owners who maintain forests growing. In 25 years the EU forest area has increased by 9 million ha, which is comparable to the area of Portugal and forest stock has increased by 38%. Forests can help to defossilize the economy by sequestration, storing carbon and substituting fossil carbon. Forest has many different products that need different outlets, different markets.

Fourth speaker: Enrica Arena, cofounder Orange Fiber srl.

Orange fiber is looking for production of fibers from waste. After taking food first, almost a half of the weight of orange is thrown away. Orange Fiber is getting new products out of this waste. These are sustainable fabrics, put on the market in partnership with the fashion and fiber industry. Today 60% of fabrics are fossil based. Fashion industry is the second biggest polluter, but it aims to be carbon positive in 2040. There, the biobased fabrics can help. This year Orange fiber produced 10.000 meters of fabrics. There has just been a new fundraising to expand the production.

Discussion:

How is bioeconomy relevant for Climate actions?

The bioeconomy is very relevant for climate actions, both in replacing fossil carbon by green carbon as in land use. To reach less than 2 degree (or better 1,5 degree) climate change, we need to do more than only look at the energy use. Land use is also important part in the picture. We need better tools (like TiSpa LCA) to account for that. 10 % of European CO₂ emissions are sequestered by forest, and an additional 10 % of that (so 1% of total emissions) is sequestered in long-living wood products.

What actions should be taken?

Support the bioeconomy. Produce more sustainably, reduce subsidies for fossil fuels, and avoid overregulation. Aim for a level playing field, boost the productivity on the supply side, invest in forest management and increase the resources. At the same time invest in the demand side: public procurement, consumer awareness, and buy-in. There is a huge need for upscaling. Startups need partnerships with existing companies. And it is more about materials than about energy, but energy is an important side stream for forest owners to help building up a bioeconomy. It would be good to show the hidden cost of products. We need also to think, how Europe affects climate change outside of Europe.

2.3 Indicators for the bioeconomy: what do we need, what do we have, what are the gaps?

Moderator: Joachim Kreysa, adviser for bioeconomy, JRC

Introduction: Giovanni De Santi, Director, JRC D.

Sound scientific evidence is needed as a basis for policy making, for this reason the Bioeconomy Knowledge Centre (BKC) has been created by the JRC to provide EC policy makers with cross-cutting analysis and information. For example, the JRC started to work on indicators for monitoring the bioeconomy but its cross-sectorial nature poses enormous challenges when it comes to developing quantitative indicators as measures to monitor its status and trends. Composite indicators can be a way forward when coupled with robust science based evidence and data.

First speaker: Defining indicators, Marcos Dominguez, JRC I.1.

Complexity is the meta-problem of our age, coupled with information overload. We are drowning in information, and we need to develop tools that help us to make important decisions wisely. Composite indicators, scoreboards and heat-maps facilitate evidence-based decision making by aggregating large number of observable variables (indicators) into an easily-digestible format. Composite indicators are powerful advocacy tools. As such, they need to be developed sensibly and responsibly, building upon sound statistical analyses. For them to be used e.g. in benchmarking, it is important to aggregate the information only up to a level that is meaningful, both conceptually and statistically.

Second/third speaker: indicators in the bioeconomy, Andrea Camia, JRC D.1.

Biophysical indicators focus on biomass and the environment where it is produced, harvested and used. However, to monitor the bioeconomy, quantitative indicators need to be developed along the entire value chain: on biological resources, on the environment, for industrial transformation processes and for circularity and sustainability. In any case, sound data are needed to create reliable indicators; to this end the JRC is working with EC services for the development of a robust knowledge base on biomass supply and demand.

Third speaker: From static indicators to future-oriented scenario analysis, Robert M'Barek, JRC D4.

The "classic" economic indicators¹ such as turnover and jobs provide already an important insight in the EU bioeconomy, showing that for these

¹ <http://publications.jrc.ec.europa.eu/repository/handle/JRC108733>

indicators the bioeconomy represents about 9% of the entire EU economy. However, the choice and visualisation matters (e.g. value added changes the share of individual sectors compared to turnover). To better understand the impact of policies or technological developments on the evolving bioeconomy that is cross sectorial by nature, a sound analytical framework is needed. Such a framework is provided by the general equilibrium model MAGNET². It allows coherently to simulate alternative possible future scenarios as it covers all economic sectors and regions worldwide and also includes all relevant policies (with different degrees of representation). The results of the model runs are presented as a comprehensive set of SDG indicators. Matrix-presentations of these indicator-sets have been proven useful for comparing alternatives in a multi-dimensional context. Challenges relate to data availability as such, e.g. to correctly represent innovative sectors in the model. Linkages to sector models need to be developed and reducing complexity to a manageable level remains an issue.

Fourth speaker: Experience with bioenergy indicators and sustainability criteria, Giulio Volpi EC, DG ENER.

Under the Renewable Energy Directive, the Commission is required to monitor biannually the progress towards the EU renewable energy target of 20% for 2020 and the national targets. The monitoring covers also the sustainability of bioenergy, including direct GHG savings, other environmental impacts on biodiversity, water and soil and also on other biomass users. Experience showed that indicators need to be simple and build on existing datasets in order to facilitate monitoring.

Fifth speaker: Environmental indicators, Anne Teller, EC DG ENV.

What we need is a correct storyline; indicators that are inter-related, making an integrated assessment. They need to cover all aspects of a life cycle, including ecosystems and the services provided. DG ENV has made substantial progress on an integrated analytical framework and indicators, and it is now time to plug it in the models and scenarios and used by JRC in order to ensure consistency across sectors and policies.

Sixth speaker: Indicators for bioeconomy policy, Katja Zboralski, Federal Ministry of Education and Research, Germany.

From the experience in Germany, we know that a small set of indicators will not work; the challenge is to correctly reflect the many interlinkages characterizing the bioeconomy. While research on bioeconomy is still fragmented; a comprehensive perspective is emerging. However, policy making and the public debate needs reliable information about the performance of the bioeconomy, its dependencies and interactions.

² <http://publications.jrc.ec.europa.eu/repository/handle/JRC108799>

Therefore, last year three German ministries (Economic Affairs and Energy, Education, and Research, and Food and Agriculture) have jointly started a three year pilot phase for developing the scientific basis for a regular systemic monitoring of the bioeconomy.

Seventh speaker: Indicators for the bio-based industries, Pilar Llorente Ruiz De Azua, Biobased Industries Joint undertaking (BBI-JU).

The EU bioeconomy is on the crossroad of the most important global challenges: climate change, food security, effective use of resources, and dependency on fossil resources. Therefore the BBI's vision is to contribute to the transition from a fossil-based economy to a bio-based one. In this respect, the BBI uses a set of 8 key performance indicators related to the transformation of the bio-based industries sector (new cross-sector interconnections, new bio-based value chains) and to the creation of new bio-based building blocks, materials and products. The BBI is committed to an integrated approach to the bioeconomy that considers all relevant global challenges and contributes to the SDGs; fully embracing all three aspects of sustainability; environmental, economic, and social.

Discussion:

The challenge is to produce more with less while reconciling the human way of live with nature. Bioeconomy should therefore be ecosystem-based and sustainable, in all three dimensions. Transparency and inclusiveness are important to convince citizens. Education and training is needed as well, to develop for example the new skills needed for new processes.

2.4 Conclusions from the climate benefits, Bioeconomy ecosystems, Bioeconomy indicators policy sessions.

From the three sessions, the common line was the importance to have sustainable production in Europe without crossing planetary boundaries, such as those on climate change, biodiversity/ecosystems and nitrogen overload. Subsidies for fossil fuels should be abolished whilst avoiding overregulation. For this, it is important to increase the resources and invest more in soft measures such as green public procurement and on consumer awareness.

Sound data are needed to create reliable indicators; to this end the Bioeconomy Knowledge Centre (BKC) is working for the development of a robust knowledge base on biomass supply and demand. Indicators need to cover all aspects of a life cycle, including ecosystems and the services provided.

Research and innovation are still important in all areas but overall, the bioeconomy has the potential to create jobs and growth while reducing greenhouse gases emissions and making progress towards some of the sustainable development goals.

3 Parallel Policy sessions on circular economy, biorefineries & bioenergy, blue Bioeconomy.

3.1 The role of bioeconomy in advancing circular economy

The session was introduced and moderated by Luisa Prista, Head of Unit, DG Chemicals Unit, DG GROW who emphasized that the bioeconomy was now moving from 'aspiration to realization'.

There were three speakers in the session: (i) Chris Thornton, European sustainable Phosphorus platform, who spoke on fertilizer regulation: "*New market opportunities for recycled nutrients from European biomass (here, especially biowaste)*"; (ii) Kristy-Barbara Lange, European Bioplastic, who spoke on "*Innovative Plastics using Secondary Raw Materials*"; and (iii) Harmen Willemse, Co-chair of Commission expert Group on Bio-based Products who spoke on "*Outputs from the Commission Expert Group on Bio-Based Products*".

"New market opportunities for recycled nutrients from European biomass, especially biowaste": Chris Thornton, European sustainable Phosphorus platform explained that fertiliser regulations are essential for the single market. Fertilisers play an important role in the bioeconomy, especially Nitrogen (N), Potassium (K), Phosphorus (P) and organic Carbon (OrC). EU policies, such as the Nitrate Directive, the Water Framework Directive and the Urban Waster Water Directive are an incentive to recycle nutrients from waste. Some of the nutrients (N, K, OrC) can be extracted from sewage, animal wastes and dead animals, subject to animal bioproduct regulations. Combustion and incineration also result in sanitization. However, Phosphorus (P) is mined and 90% of the Phosphorus used in the EU is imported, so it is important that it should be recycled. This is an opportunity to use products that are considered as waste, such as manure, as a resource and develop new jobs in the rural, circular economy. However, the volatility of the price of P is a challenge for private investment that relies on profitability.

"Innovative Plastics using Secondary Raw Materials": Kristy-Barbara Lange, European Bioplastic, explained that the term 'bioplastic' is used for both bio-based plastic and biodegradable plastic. Although these are usually thought of for packaging, there are many other potential uses including high-tech examples such as smart phone screens. Research is needed on how 'waste' e.g. from food processing of sugar cane and agave can be transformed into a secondary material resource. This can result in a cascade of high value, biobased products, such as casein from the dairy industry. However, using secondary products as raw materials needs a legislative framework that includes standards and certification. Another challenge is scaling up from a pilot study to commercial scale production.

The report on "Outputs from the Commission Expert Group on Bio-Based Products", which included 9 guiding principles and 8 policy recommendations, was summarised by Harmen Willemse Co-chair of Commission expert Group on Bio-based Products and framed in the context of the 10 Commission priorities for 2015-2019³. In particular, biobased products can deliver on jobs, growth in all sectors, rural development, opportunities throughout the supply and value chain, decrease the dependency on fossil fuels, capture carbon dioxide, make a more efficient use of biomass, reduce waste and methane emissions. A long-term perspective and vision is necessary for this to be achieved, including investment in research, market incentives such as public procurement, economic incentives, promotion and labelling to boost public awareness and acceptance.

The discussion that followed the presentations was moderated by Luisa Prista and the audience asked questions to the panel members.

Discussion

The discussion focused on two fundamental questions:

What is the relevance of the EU bioeconomy in your point of view?

What actions are needed in making further progress towards a sustainable, circular (EU) bioeconomy?

The relevance of the EU bioeconomy:

The EU bioeconomy is relevant to all regions and areas of Europe, rural, urban, and coastal.

The relevance of the EU bioeconomy is cross-sectoral, including agriculture, forestry, fisheries and industry. Thus the bioeconomy is relevant to food, feedstocks, products, including biobased products, value chains and industry, including the chemicals and materials industry.

The EU bioeconomy is relevant to many EU policies, such as the Common Agricultural Policy and the Common Fisheries Policy, the Sustainable Chemical Initiative, the Nitrate Directive, the Urban Waste Water Directive and the Water Framework Directive. It is also relevant to new policies such as the Industrial Policy Strategy.

The EU bioeconomy is also relevant to the Circular Economy and decreased dependence on non-renewable resources.

³ https://ec.europa.eu/commission/priorities_en

The EU bioeconomy can contribute to the 10 Commission priorities in particular jobs, growth, investment, energy and climate.

The EU bioeconomy has a strong, innovation capacity that includes both high and low-tech innovation.

Actions needed for making further progress towards a sustainable, circular (EU) bioeconomy:

- A long-term perspective.
- Research into sustainable, circular bioeconomy.
- Sustainability criteria, e.g. circularity requirements. Life Cycle Analysis of bioeconomy products of to establish if they really are sustainable.
- Change the perception of waste to resource.
- A range of instruments are needed such as guidelines and regulations. A stable, regulatory framework should not be a hindrance but rather simplify and streamline the development of the bioeconomy.
- Revise and update existing legislation, such as the Fertiliser Regulation to include bionutrients.
- Devise and revise new strategies such as a Plastic Strategy.
- Improve communication, e.g. the public understanding and acceptance of biobased products. Reassure the consumers about contaminants from waste of recycled materials. Clarify terminology, e.g. bioplastics and use clear labelling.
- Seek win-win solutions, for example in the carbon cycle reduce dependency on imported fossil fuels and reduce methane emission from waste. Potential in the phosphorus cycle includes reducing dependency on imported, non-renewable phosphate and reducing nutrient pollution (eutrophication).
- Incentives such as public procurement.
- Facilitate up-scaling from pilot to commercial, e.g. facilitate the collection of biowaste for large-scale processing.

3.2. *The integrated roles of biorefineries and bioenergy in the bioeconomy*

The session was introduced and moderated by Hans Van Steen, Advisor, DG ENER. There were four speakers in the session: (i) Adam Brown, Senior Energy Analyst at International Energy Agency who spoke on "*The Bioenergy Road Map 2017*"; (ii) Gisle Lohre Johansen, Senior vice president R&D and business Development, Executive Vice President Fine Chemicals, Borregaard, who spoke on "*Maximizing the value of wood in the integrated biorefinery*"; (iii) Sari Mannonen, Vice president, UPM Biofuels, who spoke on "*The Full Potential of Biorefining*" ; and (iv) Markus Rarbach, Head of Start-up Business Project Biofuels & Derivatives group Biotechnology, Clariant Produkte (D) GmbH, who spoke on "*The Chemical industry as key enabler for the circular bioeconomy*".

"The Bioenergy Road Map 2017"; Adam Brown, Senior Energy Analyst at International Energy Agency, explained that the potential of bioenergy wasn't limited to electricity generation but also important for transport. However, the topic of biofuels is complex and remains controversial. Nevertheless, biofuels can make a contribution to the portfolio of technologies needed for de-carbonization, for example a 20% emission decrease in transport. At present, this potential is not realised globally, the US, Brazil and EU are leading in comparison to China, India and Africa. A further challenge is mobilizing the large sums of finance needed to meet the Bioenergy Challenge. Especially active institutions include the Biofuture Platform, Development Agencies and Development Banks. Appropriate governance systems and regulatory authorities are necessary to develop sustainable supply chains, technology and incentives. This is key to deploy existing technologies and to provide the specific support to commercialize new technologies.

"Maximizing the value of wood in the integrated biorefinery"; Gisle Lohre Johansen, Senior vice president R&D and business Development, Executive Vice President Fine Chemicals, Borregaard explained that oil was a much easier fuel to use than biomass. Therefore, biomass has to deliver in terms of price and convenience. Current political market incentives favour low value bioenergy and biofuels rather than more valuable biomaterials and biochemicals. Different raw materials can be treated in a biorefinery to produce different biomaterials. Wood can be used in construction in a variety of ways, not just as wood, but also as chipboard, fibre and laminates, multiple by-products with multiple applications. Waste from wood sawmills and waste wood such as Christmas trees can become a valuable resource and be used in biorefineries.

"The Full Potential of Biorefining": Sari Mannonen, Vice president, UPM Biofuels, also emphasized the potential of wood-based biofuels. Biorefineries can use waste from wood pulping residue to produce sustainable biofuels and other products. For the potential growth and jobs to be fully realised, more research and investment is needed, as well as

stable regulations. Additional, environmental benefits include decreased NO_x and atmospheric particles.

“The Chemical industry as key enabler for the circular bioeconomy”

Markus Rarbach, Head of Start-up Business Project Biofuels & Derivatives group Biotechnology, Clariant Produkte (D) GmbH, explained the link between biobased chemicals industry and the energy industry, giving examples such as cellulosic ethanol. He explained that it is necessary to support innovation and stabilize the market to bridge the gap from niche to norm and for the full potential to be realised.

There followed a discussion moderated by Hans VAN STEEN and questions for the audience to the panel members.

Discussion

The discussion focused on two, fundamental questions:

- What is the relevance of the EU bioeconomy in your point of view?
- What actions are needed in making further progress towards a sustainable, circular (EU) bioeconomy?

The relevance of the EU bioeconomy:

The EU bioeconomy decreases dependence on non-renewable resources with a lot of potential in the transport sector. This can lead to win-win opportunities in the C-cycle, but this is complex and still controversial.

The relevance of the EU bioeconomy is cross-sectoral and there are potential synergies between sectors, e.g. construction and chemical industry.

The bioeconomy makes use of waste (e.g. Christmas trees, pulp residues, and autumn leaves) as resources for multiple products and materials, and thus is linked to the circular economy.

The EU bioeconomy has a strong, innovation potential.

The EU bioeconomy can deliver jobs and growth.

Actions needed for making further progress towards a sustainable, circular (EU) bioeconomy:

- Research into innovation.
- Life Cycle Analysis from source to consumer and criteria for sustainability.

- Clear policy framework, guidelines and regulations.
- Stability to stimulate the necessary investment to bridge from development to market.
- Promotion of wood products in construction.
- Caution with incentives that can skew development, e.g. by favouring biofuels.

3.3 A dive into the blue bioeconomy

The session was moderated by Bernhard Friess, Director, DG MARE who introduced the blue-economy forum and emphasized the new, innovative businesses that are developing.

There were four speakers in the session: (i) Daniela Schmidt, University of Bristol, who spoke on "*Generating food and biomass from the oceans*"; (ii) Neil Auchterlonie, The marine Ingredients organisation (IFFO) who spoke on "*Marine ingredients for the bioeconomy*"; (iii) Vítor Verdelho Vieira, European algal Biomass Association (EABA), who spoke on "*Technology and markets for algae*" ; and (iv) Pierre Erwes, Biomarine, who spoke on "*Investing in the blue bioeconomy*".

"Generating food and biomass from the oceans"; Daniela Schmidt, University of Bristol summarised some of the findings of the report "Food from the Oceans". This was explained in the context of climate change, which is changing the distribution of species with different, regional effects. A further stress is the effect of ocean acidification on bivalve production. Waste from fish processing, such as viscerals and skins can be a bioeconomy resource, but incentives are needed for these, and bycatch, to be landed. The use of appropriate management systems and selective fishing gear can reduce by-catch. There is also potential from polyculture of species. Consumers are resistant to the concept of genetically modified seafood.

"Marine ingredients for the bioeconomy"; Neil Auchterlonie, The marine Ingredients organisation (IFFO) listed some of the multiple and valuable products from the sea, e.g. fish oil, nutraceuticals such as omega-3, marine peptides, petfood and fish meal. He emphasized that fish meal is difficult to replace because of the complex amino acids and vitamins that it contains. This links 3 sectors, fisheries, food processing and aquaculture and contributes to the circular economy. Certification is essential throughout the supply chain.

"Technology and markets for algae"; Vítor Verdelho Vieira, European algal Biomass Association (EABA), explained that algal biomass includes

micro-algae as well as seaweeds. Seaweeds are mainly harvested while microalgae are mainly cultured and farmed at different scales. They have 8 main applications, 4 of which are of high value such as for pharmaceuticals and 4 of lower value, such as fertiliser. The algae are processed to produce 3 main product types: paste, dried and extracts. This sector is growing in terms of jobs and turnover.

“Investing in the blue bioeconomy”; Pierre Erwes, BioMarine, introduced a bewildering variety of different products available from the sea, such as chemotherapy ingredients from crab shells. He explained how networking knowledge providers, venture capitalists and SMEs can produce innovation in the blue economy using a range of examples such as Biomarine, Blue-Gen, My Blue City and Blue Forward.

There followed a discussion moderated by Bernhard Friess and questions for the audience to the panel members.

Discussion

The discussion focused on two, fundamental questions:

What is the relevance of the EU bioeconomy in your point of view?

What actions are needed in making further progress towards a sustainable, circular (EU) bioeconomy?

The relevance of the EU bioeconomy:

- Adaptation to climate change and ocean acidification.
- Food security for a growing population: the blue-bioeconomy can boost food production from the sea and diversify food types, e.g. by increasing the consumption of algae.
- The relevance of the blue-bioeconomy is cross-sectoral and there are potential synergies between sectors, e.g. fisheries, food processing and aquaculture.
- The blue bioeconomy includes making better use of waste (e.g. fish skin and viscerals, as seen in the plenary video) as resources for multiple products and materials, and thus is linked to the circular economy.
- The blue-bioeconomy has a strong, innovation potential.
- The blue-bioeconomy can deliver jobs and growth in aquaculture and blue-biotechnology.

- The blue-bioeconomy can provide new pharmaceuticals and nutraceuticals from the sea.
- The blue-bioeconomy can provide biofuels from algae, thus reducing dependence on imported fossil fuels.

Actions needed for making further progress towards a sustainable, circular (EU) bioeconomy:

- Technological innovation especially in selective fishing gear, on-board processing of seafood.
- Research and innovation especially of marine biochemicals, nutraceuticals and pharmaceuticals, polyculture and aquaculture of new species, e.g. sea cucumber, algal farming and products.
- Management systems and waste collection cooperatives.
- Upscaling of pilots (e.g. algal farms).
- Educate and communicate: promotion of seafood, re-assuring the public and consumers about products.
- Networking knowledge holders, innovators with investors.
- Stability to stimulate the necessary investment to bridge from development to market.
- Incentives e.g. fish meal production on-board.
- Life Cycle Analysis from source to consumer and criteria for sustainability.
- Clear policy framework, guidelines and regulations (e.g. additives and CEN standards for algae).

3.4 Conclusions from circular economy, biorefineries & bioenergy, blue Bioeconomy

This section provides an overview and synthesis of the discussions held in the three sessions addressing the two, fundamental questions:

What is the relevance of the EU bioeconomy in your point of view?
 What actions are needed in making further progress towards a sustainable, circular (EU) bioeconomy?

Bioeconomy is relevant to many EU policies, economic sectors and regions of Europe. The EU Bioeconomy also addresses societal challenges and Juncker priorities.

Europe has a huge potential of resources: a large quantity of biomass and biobased material is available and they are cross sector and cross value chains.

A good technology already exists but has to be developed in a systemic way.

Also, a stable Policy framework and a positive public perception of bio-based products are extremely important to mobilise investments in this sector.

As regards as bioenergy, although it will make a substantial contribution particularly in the transport sector that in the future will actually grow, some controversial aspects were raised during the discussion: there is a huge difference between profitability and convenience with respect to biomass and oil, also in terms of price and profitability. However it is not just for bioenergy purposes that we should be looking at Biomass; there are multiple products and applications that can be taking into consideration in particular from woods.

Finally, for the Blueeconomy section, it has stressed the huge potential to boost food from the sea and to diversify different products: this can be from marine ingredients, algae using catch and by catch and waste and finally getting high value products like pharmaceutical in the fight against cancer.

It is important also to connect the innovation with the investment to boost growth and jobs, without forgetting the public acceptance: it is possible to reduce the ocean acidification through the use of algae, but for this, we would need the acceptance from the consumer.

4 Final Conclusions

A **sustainable, circular bioeconomy** has the potential to reconcile human needs with nature, in the context of Sustainable Development Goals, and to ease the **transition to a post-fossil-fuel future**.

The bioeconomy is **cross-sectoral** and vast, encompassing **all regions of Europe**, from traditional activities, such as cork harvesting, to cutting-edge technology.

The bioeconomy is often misunderstood because of its diverse nature. Actors in the bioeconomy may not even be aware of their contribution to

the whole bioeconomy because they consider themselves as part of one sub-sector. The bioeconomy therefore **requires education**, changes in **public perception** and **research**.

A sustainable, circular bioeconomy can help us to solve complex problems by identifying common solutions, to **produce more with less**, to **use waste as a resource** and to develop bio-based technologies.

These innovations can deliver **jobs**, **growth**, and **opportunities** in rural areas.

Complex, cross-societal policy-making and actions are necessary for the full potential of the bioeconomy to be realised. This also requires a **longterm perspective** and **stability** to stimulate **investment** to **upscale** from pilot studies to commercial scale.

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The report outlines the discussions that took over the Bioeconomy Policy day organized by the European Commission and aimed at highlighting the progress made so far on the Bioeconomy Strategy launched in February 2012. The event started with an introduction on why the strategy was needed, what is covered and the progress made so far. This was followed by the nine parallel sessions organized by the different directorates-general, co-signatories of the 2012 Bioeconomy Strategy. This report outlines the discussion in each of the sessions, describes briefly any relevant projects mentioned, discusses the importance of EU policies in shaping the Bioeconomy revision and highlights any particular issues during the sessions.

Studies and reports

