The Bioeconomy concepts and its implications –

Food for thoughts for understanding and implementing a “Bioeconomy in Action“

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Bioeconomy since 2005

The Bioeconomy of the last 14 years draws on 4 main pillars:

(1) Exploitation of the potential of biological resources,

(2) The integration of new knowledge coming from various disciplines, linking it with biotechnologies and life sciences,

(3) Contributing to the emerging biological and digital transition or transformation,

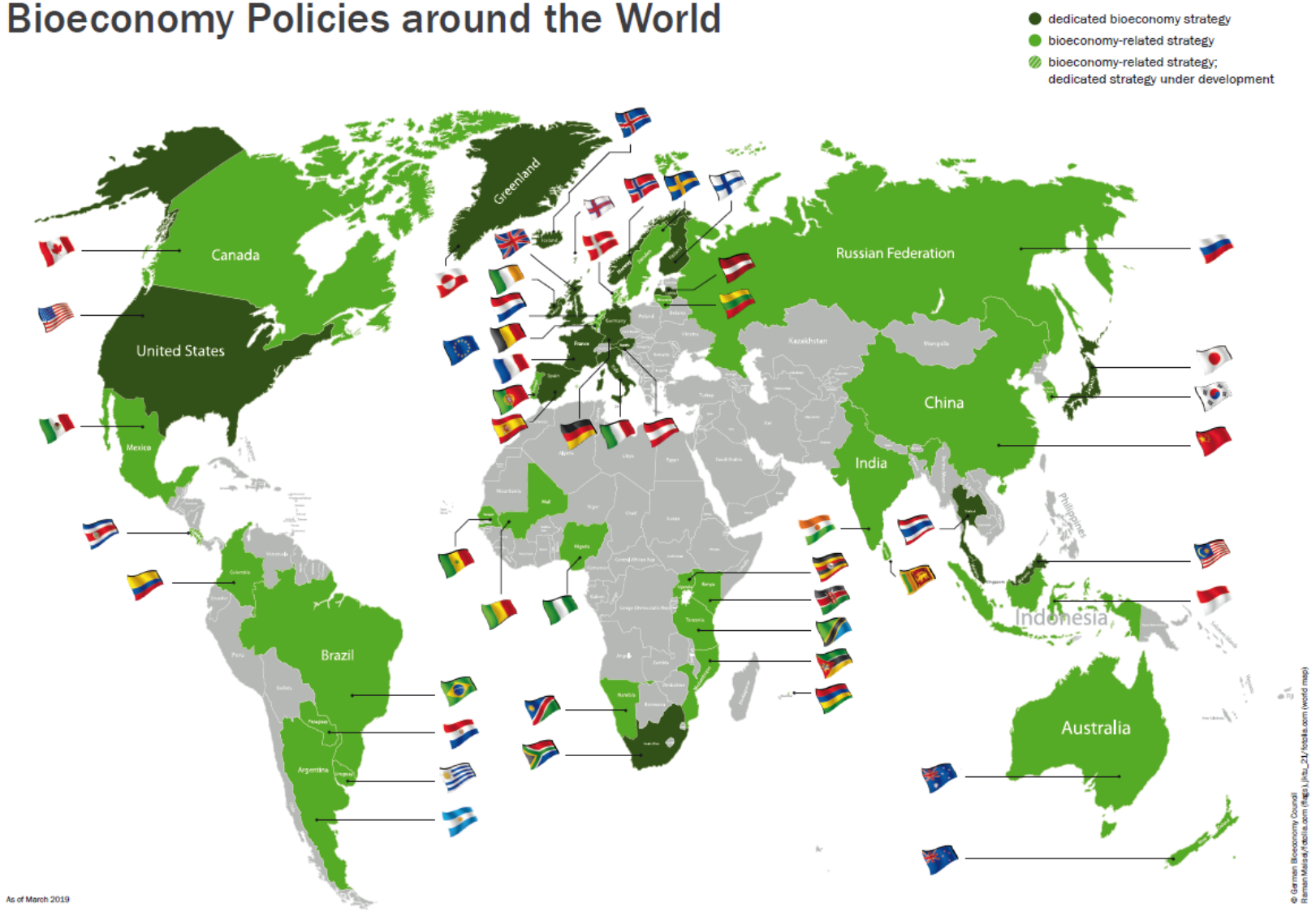
(4) Offering new partnerships and interactions in achieving Sustainable Development Goals (SDG) and enabling a Circular Economy, and this vice versa.

Just to recall - Characteristics of biological resources:

The uniqueness of some remarkable features of biological resources makes them attractive for becoming the possible fundament of an economy:

- Their Renewability.
- Their $C0^2$ -“ friendliness”or even sometimes carbon neutrality.
- Their Re-use or multiuse, also in the format of cascades.
- Their potentials for new, better functions in their products, e.g. higher stability, longer life, stronger endurance, less or no toxicity, less water use etc..

Bioeconomy Policies around the World



Source: National Bioeconomy Council, BÖR, March, 2019

Present status – Today

- About 60 states worldwide and half a dozen regions officially support the bioeconomy either via dedicated programmes, strategies, action plans, roadmaps etc. or via closely related political, programmatic and/ or strategic activities, the majority of them still in Europe.
- Canada is the only case where we find a strategy, exclusively elaborated by industry!
- Many of these activities, however, are limited to biotechnology and/ or biofuels production and use.
- Today, almost 14 years after it‘s launch there is no more a single bioeconomy but there are many bioeconomies!
- This has an impact on the necessary frameworks, public funding, private investment and thematical content.

Present status (cont.)

- During the last 12 months, only in Europe, Ireland, the **Nordic Council**, **UK** and **Austria** published their own Bioeconomy strategies, in some cases, like **France,** followed by dedicated Action Plans. The EU adapted their 2012 strategy in October 2018**. Italy** adopted in May 2019 its new revised strategy BIT, including an action plan.
- **Canada** owns an exclusively privately worked out strategy.
- **Czech Republic, Iceland, Sweden, Estonia** and **Lithuania** are working on their own strategies as well. **Turkey, Argentina, Brazil, New Zealand,** and **Namibia** plan their own strategies, in different state of progress. Germany is revising her two existing strategies, putting them in one coherent strategy together until summer 2019.

Present status (cont.)

- Interesting developments in the **VISHRAD Group (Poland, Czech Republic, Slovakia and Hungary),** focusing on regional and local bioeconomies, including biocities (BioEast Initiative).
- **G7 and G20** have been dealing with the bioeconomy during the last years but, no concrete results.
- First Bioeconomy Investment Summit was held by the EC in Brussels in Nov 2015; the second was held in Dec 2017 in Helsinki.
- First **Global Bioeconomy Summit** was organized in Berlin, the second in April 2018 with a very interesting long communiqué which deserves much attention. A third **GBS** is planned for **18th – 20th November 2020** in **Berlin**.

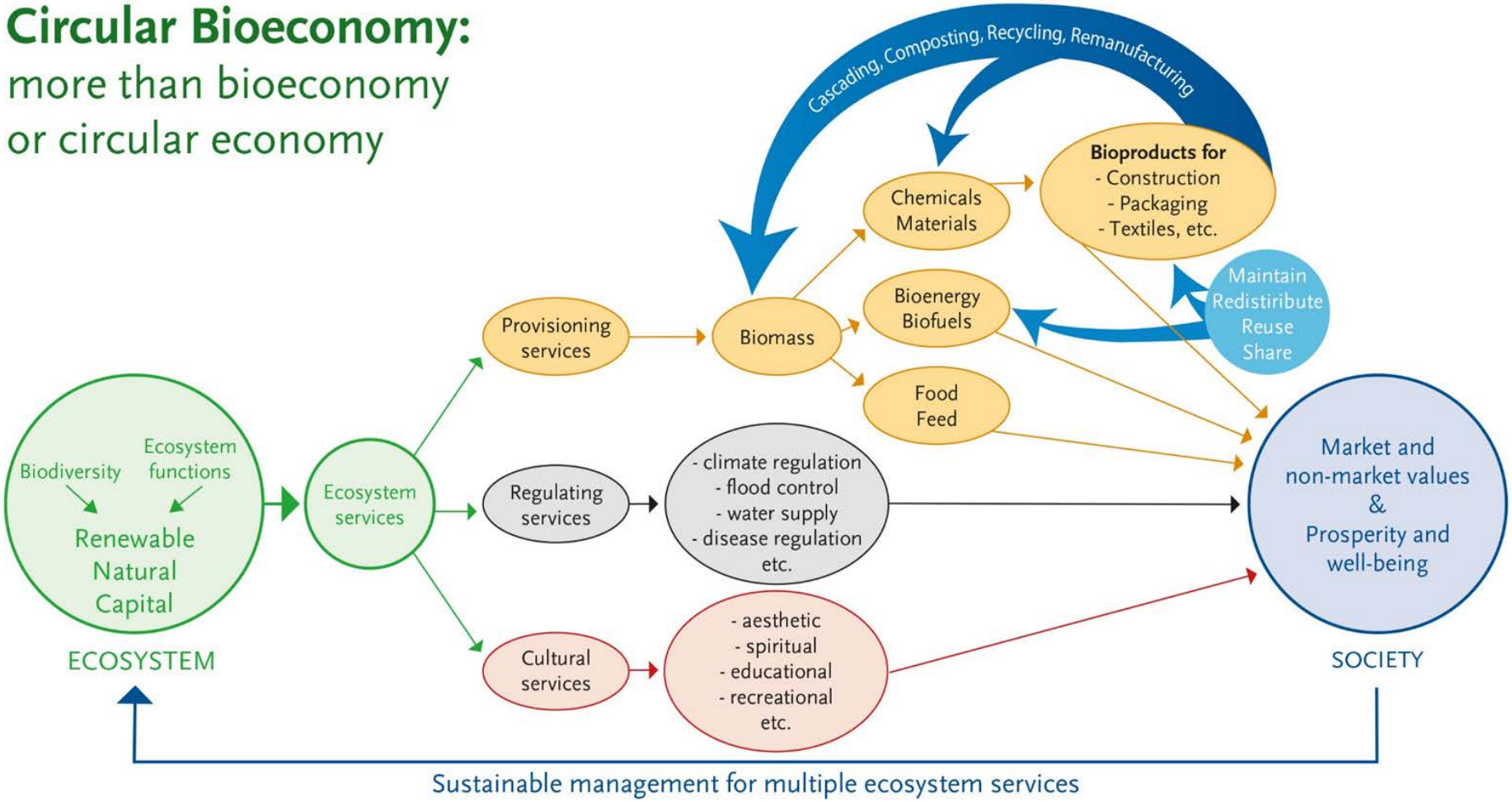
Circularity element is getting relevant

Circular economy and the bioeconomy are true partners in sustainability!
Excellent contribution by the European Environmental Agency in Copenhagen, EEA from 2018.

Some practical illustrating examples:

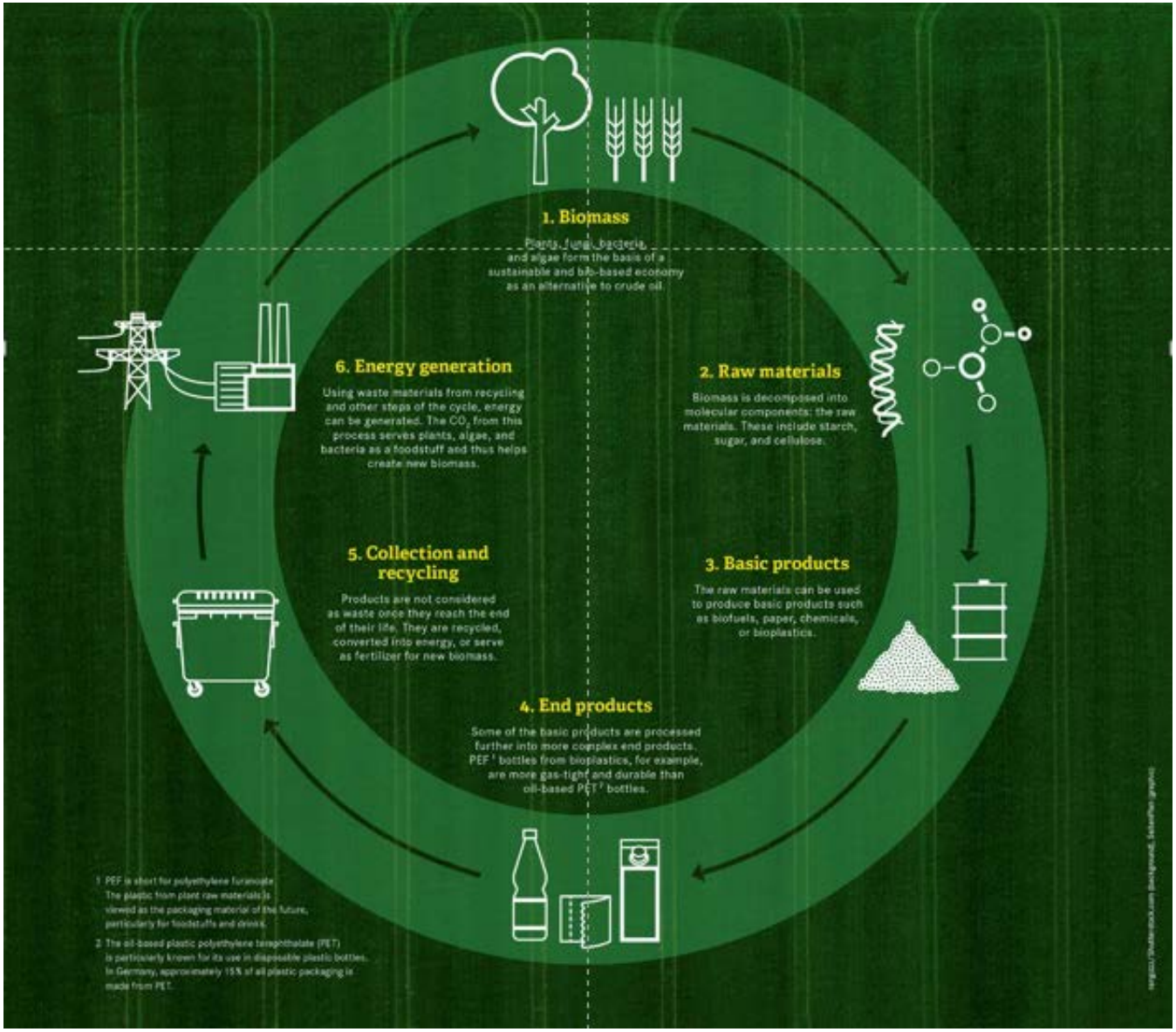
- Biorefining;
- 3-D printing with bioplastics;
- Multipurpose crops;
- Valorizing residues , in particular food waste!

Circular Bioeconomy:
more than bioeconomy
or circular economy



Source: Hetemäki, L., Hanewinkel, M., Muys, B., Ollikainen, M., Palahí, M. and Trasobares, A. 2017. Leading the way to a European circular bioeconomy strategy. From Science to Policy 5. European Forest Institute.

Bio-based recycling economy



Source: Forschungszentrum Jülich, rangizzz/Shutterstock.com (background), Seitenplan (graphic). Detail.

THE GLOBAL GOALS
For Sustainable Development

Cirularity and sustainibility will strongly influence further directions of biobased economies around the world and in Europe...

- On the choice of topics, goals and objectives
- On the ways of implementing the Bioeconomy
- On new demands and challenges for education and training
- On new demands and challenges for communication and funding

Important areas of application for the Bioeconomy of tomorrow

- Assured healthy food and feed supply for per-urban and urban areas, using new bio-based ways of packaging, chilling, prolonged shelf-life, guaranteed freshness, quality and origin, also benefitting from new digital technologies.
- Combating plastics on land and in the seas, their production, their processing, their recycling, reuse, emphasizing the replacing of micro-plastics and on their avoidance worldwide!!!

Important areas of application for the Bioeconomy of tomorrow (cont.)

- Coping successfully with food and feed waste in urban and per-urban areas. According to FAO (Report on Global Food Losses and Food Waste-Extent, Causes and Prevention, 2016) food and feed waste in urban areas represent the 3rd largest source of GHG emissions worldwide.
- Strong role against this background will be joining forces with the digital transformation!

Important areas of application for the Bioeconomy of tomorrow (cont.)

- More attention is recently paid to the biobased closing of waste cycles, hereby contributing to a better supply of so-called rare and/or critical raw materials (CRM), important for technologies developing E-mobility, Additive Manufacturing, 3-D Printing, Artificial Intelligence, but also water reuse, etc..

  These aspects of optimizing CRM's availability, so-called “Raw Materials Safety" is hitherto strongly underestimated in former and present discussions on the potentials and goals of a circular Bioeconomy, but is gaining momentum.

New trends

- Lately, we face a stronger emphasis on “soft-skills” for enabling or optimizing the implementation of the Bioeconomy in three areas:
  - New ways for funding (thematic investment platform by the EU and EIB)
  - New ways for academic and vocational education and training (establishment of an education platform among more than 25 European universities and other stakeholders)
  - Need for new ways of communication, although calling for a new platform of best practices, exchange of views, etc.

New trends in Society

- Within societal strategic discussions on future and how to cope with global challenges, the bioeconomy has now become a serious partner for dialogue with supporters of the **G**lobal **S**ustainability **D**evelopment to achieve their goals and also with the followers of a circular economy.
- Growing awareness that achievement of **GSD** goals and also of implementation of the circular economy will only be possible by an increased use of biological resources. But how to do this scientificly based and evidenced? The second GBS 2018 tried to give answers.
- Bioeconomy is the biological power engine of the circular economy, not just an integral part of it! There is more and more talk about the sustainable circular Bioeconomy!

A last trend worldwide and in particular in Europe –

The Bioeconomies move into the regions,

lately even into urban and perurban regions.

Some interesting examples and maybe models (1):

- **Germany**
  - Regional strategy of North-Rhine Westphalia and Baden-Württemberg; the latter will be revised and updated as a new regional strategy in the near future;
  - a lead market initiative on bio-based chemistry by Sachsen-Anhalt;
  - others in Hessen, Brandenburg, Bavaria and Mecklenburg are in different stages of preparation.
- **Belgium, Flanders**
  - One of the oldest regional strategies plus action plan.

Some interesting examples and maybe models (2):

- **The Netherlands**
  - Many regional activities, but no dedicated regional strategy, mostly in the Delta, Rotterdam, etc. areas.
- **France**
  - Preparation of a regional strategy for the newly formed region Grand-Est, reaching from Reims to Strasbourg;
  - Establishment of an European Center for Biotechnology and Bioeconomy in Reims.
- **Spain**
  - Many regional strategies and action plans already in vigour: Andalucia, Estremadura, Castillia y Leon, underway for Catalunya, and the Basque region (only action plan).

Some interesting examples and maybe models (3):

- **Italy**
  - The new Italian Strategy BIT of May 2019 stresses with many examples the role of regions in Italy;
  - a position paper of the Conference of Regions and Autonomous Provinces on the potentials of the Bioeconomy;
  - in addition quite a few regional bio-based R&D centers in Piemont, Lombardy, Veneto, Emilia Romagna, Basilicata, Sardinia etc..
- **Sweden**
  - for Southern Sweden (Skane) a comprehensive handbook of instructions for building up a Bioeconomy has been issued.

Some interesting examples and maybe models (4):

- **Finland**
  - Many regional activities around Helsinki, Joeensu and in various regions of Karelia, but no dedicated action plan.
- **Poland**
  - Various activities on regional level, " Bioeconomy Forum of Lodz“;
- **Scotland**
  - Since 2014 a regional road map for biorefining.

- Thus a fragmented, but highly diverse picture
- a dedicated urban Bioeconomy strategy is however missing

Trends in industry and business fields

- More than 50 chemical molecules are to be gradually replaced to be biobased, in particular within selected polymer families like PHA, PLA, PUR and polyamides and acids like polyactive acids, FDCA, succinic and levulinic acid just to name a few; very encouraging signs for the “greening“ of chemistry which will however be a long term process.
- Recent practical examples: Biobased textile products (cellulosic fibers) and biobased construction materials (e.g. biobased castor oil-asphalt cement mixtures for longer life-time in road construction) are more and more appearing on the markets.

Trends in industry and business fields (cont.)

- The trend towards new composite and packaging materials is also accelerating.
- Industries broaden their portfolio of application more and more also to daily consumer goods, health care articles, cosmetics, cloths and garments, from biobased PET and PEF-bottles, shirts, eye-wear, shoeshine articles, rollers of longboards, hulls of ballpoints, toothbrushes, rubber tires and coatings for automotives and train coaches to biobased mortar and heat-damming , non flammable foams.

What can be concluded from these recent industrial developments inside and outside Europe?

- There is a growing number of biobased production lines for intermediates and platform molecules, all focused around the renewable “C“ !

- There is a shift from science and research activities on the content of biological resources to more optimization of industrialized **processes** (hydrothermal, biological or combination of both).

- There is a shift from the cell factory to the real factory with the necessary growing attention on economics. This requires stronger attention also on elements of the back-end of value chains like norms, standards, marketing and consumer acceptance.

What can be concluded from these recent industrial developments inside and outside Europe? (Cont.)

- In addition CO_2 turns out more and more to become a potential resource in particular in Germany, as well as waste and proteins become important objects of the bioeconomy.
- The frontiers among chemical products, biofuels, proteins for food and other purposes as well as for the concrete attribution to diverse industrial application fields start to become „blurred“!
  This might reach a new dimension by a stronger use of big data in the future.

What can one conclude from these developments and trends for a "Bioeconomy in Action" ?

- There is no Bioeconomy as such, but we face many Bioeconomies around Europe and the World, depending on many national, regional and even local factors.
- National or regional strategies, by all means also including accountable action plans and road maps (!) can be very helpful to get more attention, visibility, planning security, also sharpening sense for priority-setting. Such activities should also be flanked by relevant stakeholder platforms, geographical or topical clusters, stressing the relevance of value chains, and smart and open-minded communication and education campaigns.
- Demonstration of best practices and availability of a toolbox of successful products are also very useful for a better understanding of biocomplexities.

What can one conclude from these developments and trends for a "Bioeconomy in Action" ? (Cont.)

- Circular Economy, BioEconomy and the achievement of SDG´s form a "Golden Triangle" in partnership; they complement each other.
- Bioregions and biocities are getting more and more attention and offer excellent opportunities for practicing circular biobased activities.
- The original concept of the Knowledge Based BioEconomy, KBBE, integrating converging technologies like Info-Nano-Commu-Cognitive Science and Technologies is more valid than ever, looking at the role and potentials of Digitalisation ("Digitainable“ and Artificial Intelligence).

Thanks for your attention.