UNIVERZITA J. E. PURKYNĚ V ÚSTÍ NAD LABEM

Bioeconomy Strategy of the European Union with Special Focus on Renewables Including Miscanthus

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Agenda

1. **Bioeconomy and biotechnology**
2. **Bioeconomy strategy of the European Union**
3. **Renewables / Miscanthus**
   - **Future projects**
   - **Ph.D. projects**

Bioeconomy and biotechnology

Different interpretation of terms

- **Bioeconomy**

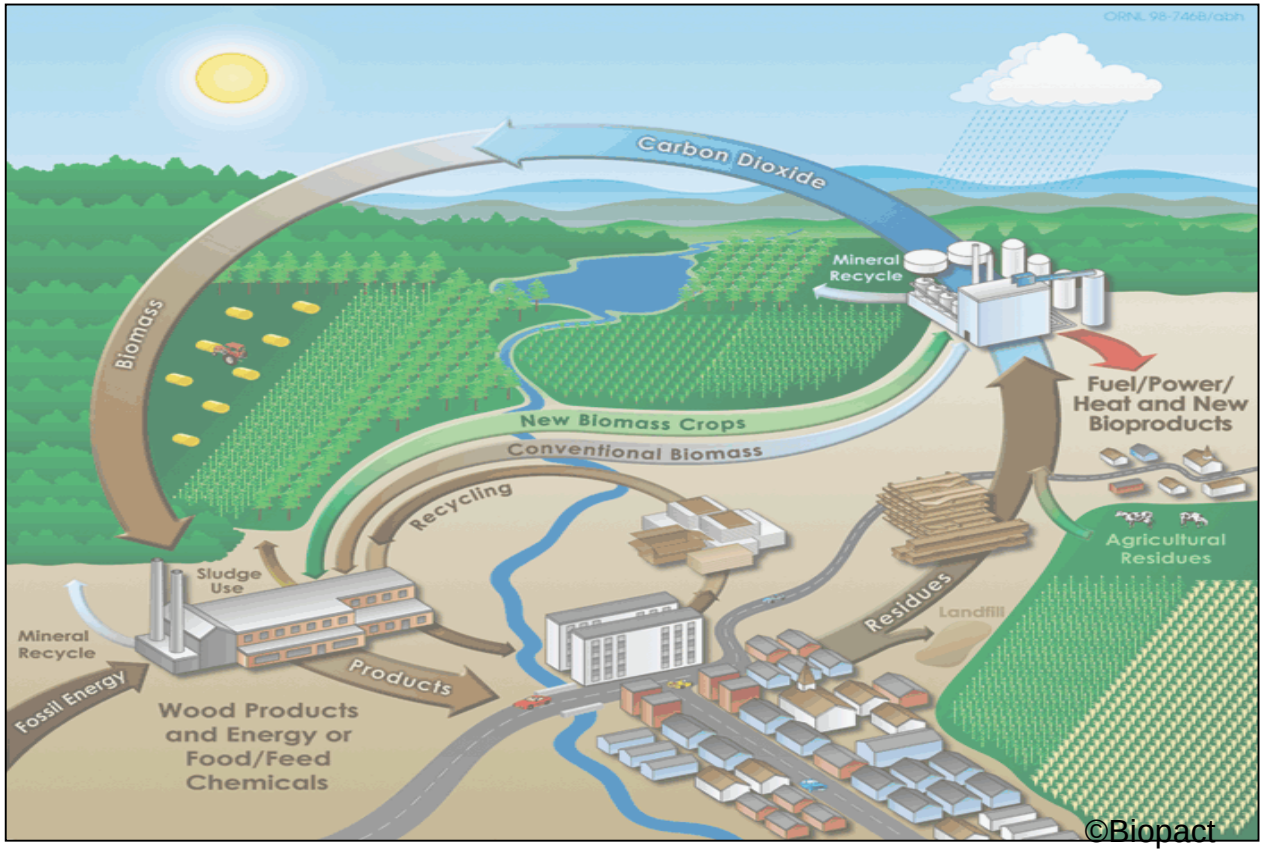
The bioeconomy […] encompasses the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy. (European Commission 2012)

- **Biotechnology**

Any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use. (UNEP 1992)

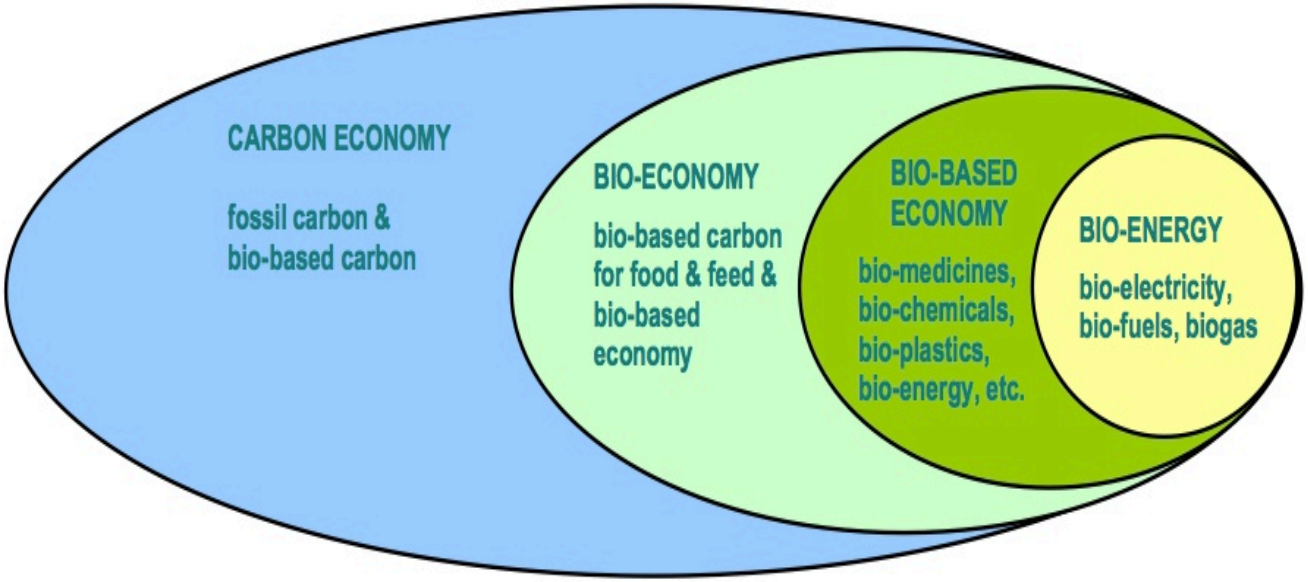
The Bioeconomy Concept

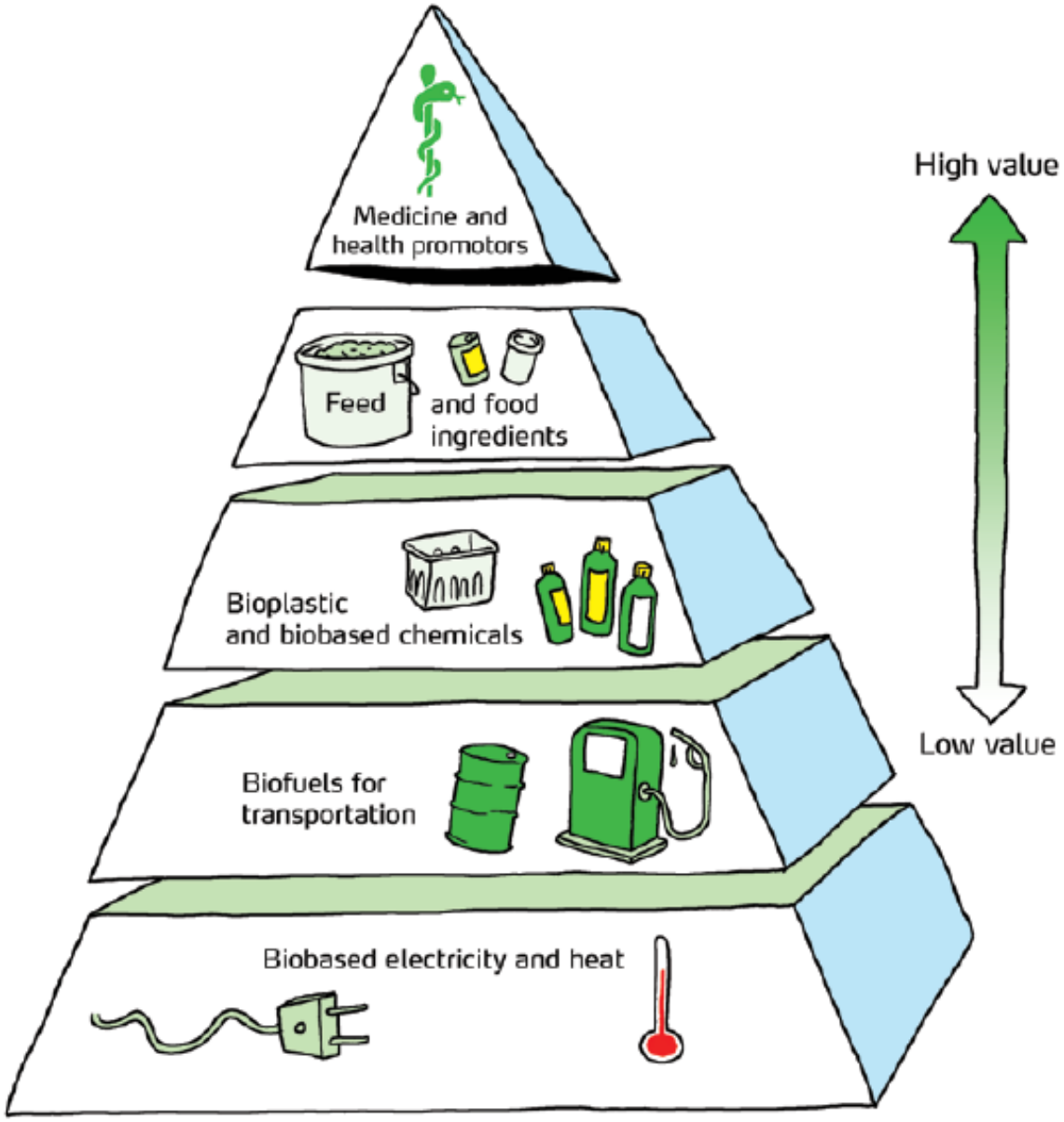
Using research and innovation to produce renewable resources sustainably in **agriculture, forestry, fisheries and aquaculture**…



…and to process renewable raw materials into value added products in the **food, bio-based and energy industries**.

Bioeconomy


CARBON ECONOMY
fossil carbon &
bio-based carbon
BIO-ECONOMY
bio-based carbon
for food & feed &
bio-based
economy
BIO-BASED
ECONOMY
bio-medicines,
bio-chemicals,
bio-plastics,
bio-energy, etc.
BIO-ENERGY
bio-electricity,
bio-fuels, biogas

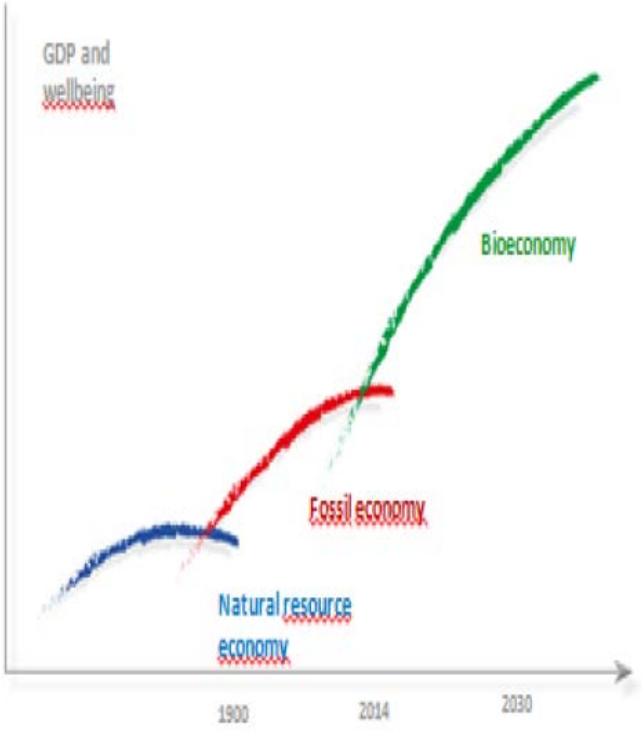

Medicine and
health promotors
Feed
and food
ingredients
Bioplastic
and biobased chemicals
Biofuels for
transportation
Biobased electricity and heat
High value
Low value

The Bioeconomy

- Replacing fossil sources and reducing GHG emissions
- Enhancing energy security
- Potential for new, innovative & green products
- Huge potential for growth and jobs
- Important part of a circular economy

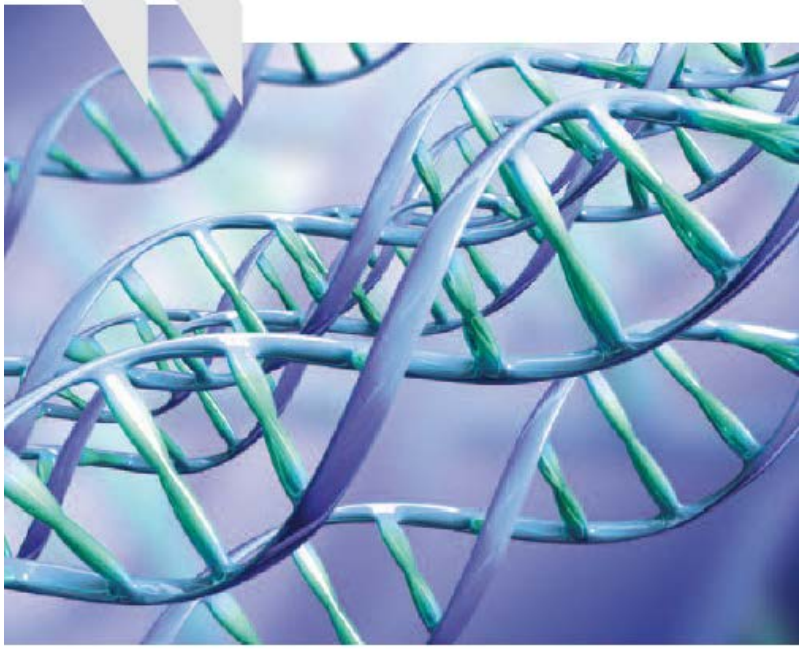
- Difficulties / external factors: low oil prices, access to financing, competition between energy/material use of biomass
- "Bio-economy" is not an established sector, but at the cross-road between many different sectors involving a wide range of diverse actors
- Boundaries between biomass and waste are fluid, as "bio-based" products may be defined in different ways

Bio-based industries



- The **bio-based industries** sector in the EU is currently of about 57 billion € in annual turnover with 300,000 direct and indirect jobs
- Bio-based industries increase EU competitiveness through reindustrialisation and sustainable growth and strengthen rural economies

Bioeconomy perspective



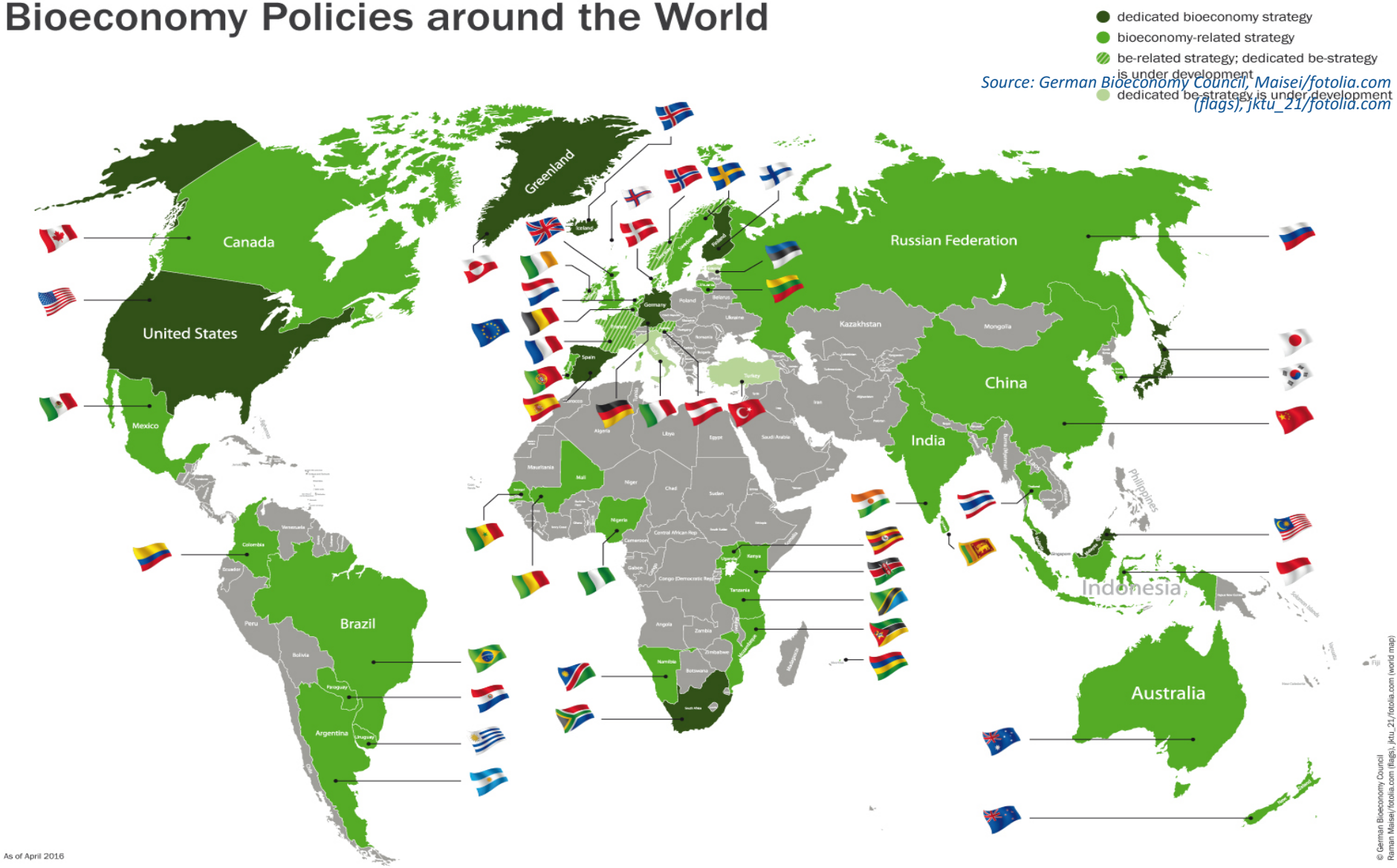
2004

primary production, health and industrial sectors that either used biomass or with current or potential applications for biotechnology

- accounted for 5.6% of the GDP of the European Union and
- 5.8% of the GDP of the United States

(Zika et al., 2007)

Bioeconomy Policies around the World



Source: German Bioeconomy Council, Maisei/fotolia.com (flags), jktu_21/fotolia.com

USA

The National Bioeconomy Blueprint (2012)

1. Support **R&D investments** that will provide the foundation for the future bioeconomy.
2. Facilitate **the transition of bioinventions from research lab to market**, including an increased focus on translational and regulatory sciences.
3. Develop and reform **regulations** to reduce barriers, increase the speed and predictability of regulatory processes, and reduce costs while protecting human and environmental health.
4. Update **training programs** and align academic institution incentives with student training for national workforce needs.
5. Identify and support opportunities for the development **of public-private partnerships** and precompetitive collaborations—where competitors pool resources, knowledge, and expertise to learn from successes and failures.

http://ec.europa.eu/research/bioeconomy/

Communication on «Innovating for Sustainable Growth: A Bioeconomy for Europe»

2007 Jan, Köln	*DE Presidency Conference* *Enroute to a Knowledge-Based Bioeconomy*
2010 Sept, Gent	*BE Presidency Conference:* *"The knowledge based bio-economy towards 2020".*
13 February 2012	***Adoption and presentation by the European Commission***
15 February 2012	*Presentation to the EU Council* ***Research Working Party***
21 February 2012	***Lunch debate*** *presentation to the* ***Competitiveness Council***
26-28 March 2012	*DK Presidency -* ***Conference "Bioeconomy in Action"*** *as launching event*
4 April 2012	*The* ***Copenhagen Declaration for a Bioeconomy in Action***

52 PARLIAMENTMAGAZINE 20 February 2012

Communication on «Innovating for Sustainable Growth: A Bioeconomy for Europe»

2012 Nov, Brussels	*New Skills for a European BIoeconomy*
2013 Feb, Dublin	*IE Presidency – 2nd Bioeconomy Stakeholder's Conference "Bioeconomy in the EU: achievements and directions for the future"*
2014 Sept, Turin	*IT Presidency – 3rd Bioeconomy Stakeholders' Conference: "From sectors to system, from concept to reality"*
2015 Nov, Brussels, Berlin	*- Bioeconomy Investment Summit* *- Global Bioeconomy Summit*
2016 April, Utrecht	*NL Presidency - "4th Bioeconomy Stakeholders' Conference"*
2016 Oct, Lodz (6-7) ***Bratislava (17)***	*- Bioeconomy Congress* *- SK Presidency - "**The role of regions in the European Bioeconomy"***

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Two documents

Commission Communication COM(2012) 60

«Innovating for Sustainable Growth: A Bioeconomy for Europe»

Bioeconomy Strategy and Action Plan (available in all EU languages)

Accompanying Staff Working Document SWD(2012) 11

- Section A:Background to the Bioeconomy Strategy and Detailed Action Plan
- Section B:Estimating the impact of EU level research funding and better policy interaction in Bioeconomy

A cornerstone of the EU economy

In 2010, the **Bioeconomy** represented

- 2 trillion € annual turnover
- 1 trillion € value added, ±9 % GDP
- 22 million jobs, ± 9% of the EU's workforce

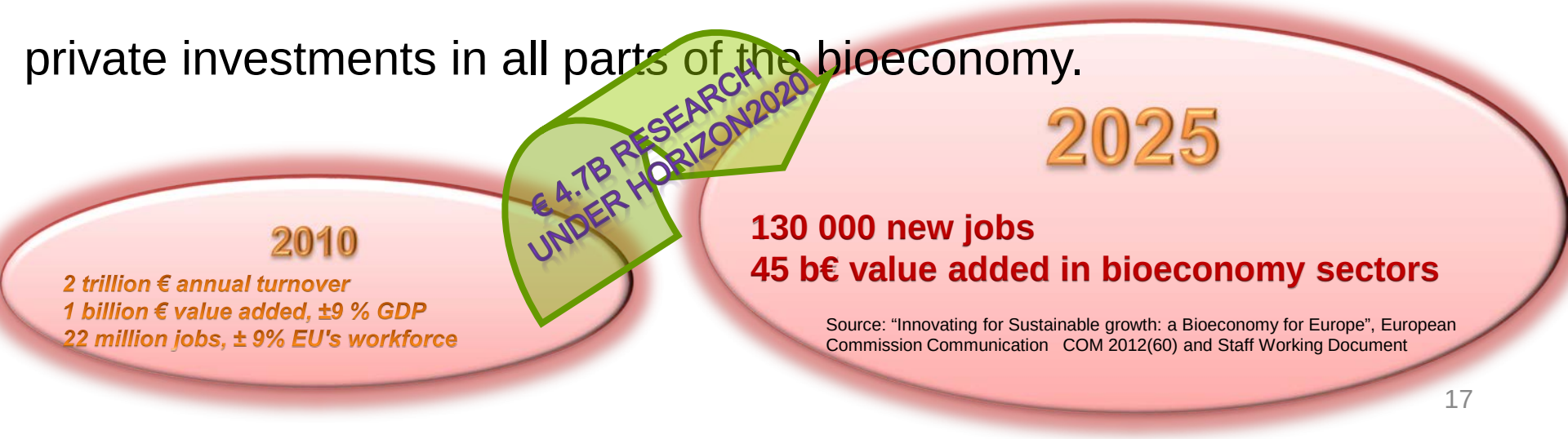
Sector	Annual turnover (bil€)	Employment
Food	965	4,400
Agriculture	381	12,000
Paper/Pulp	375	1,800
Forestry/Wood ind.	269	3,000
Fisheries and Aquaculture	32	500
Bio-based industries		
Bio-chemicals and plastics	50 (est.)	150 (est.)
Enzymes	0.8 (est.)	5 (est.)
Biofuels	6	150
Total	2,078	22,005

High growth potential

By 2025, € 4.7 billion research funding associated to the Bioeconomy Strategy under Horizon 2020 could generate:

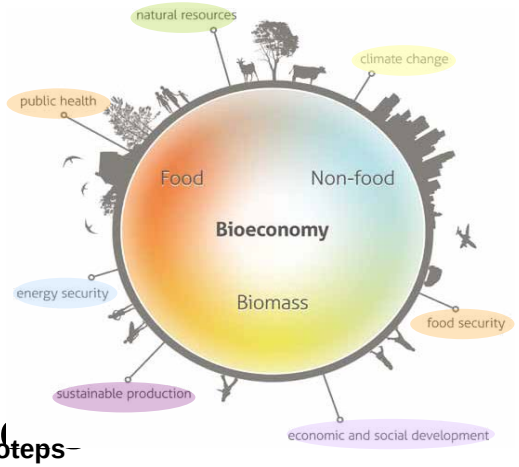
- 130 000 new jobs (800 000 jobyears)
- 45 billion € value added in bioeconomy sectors (10x return)

Further growth is expected from other – direct and indirect – public and private investments in all parts of the bioeconomy.



Source: "Innovating for Sustainable growth: a Bioeconomy for Europe", European Commission Communication COM 2012(60) and Staff Working Document

The Bioeconomy Strategy contributes to tackling societal challenges:

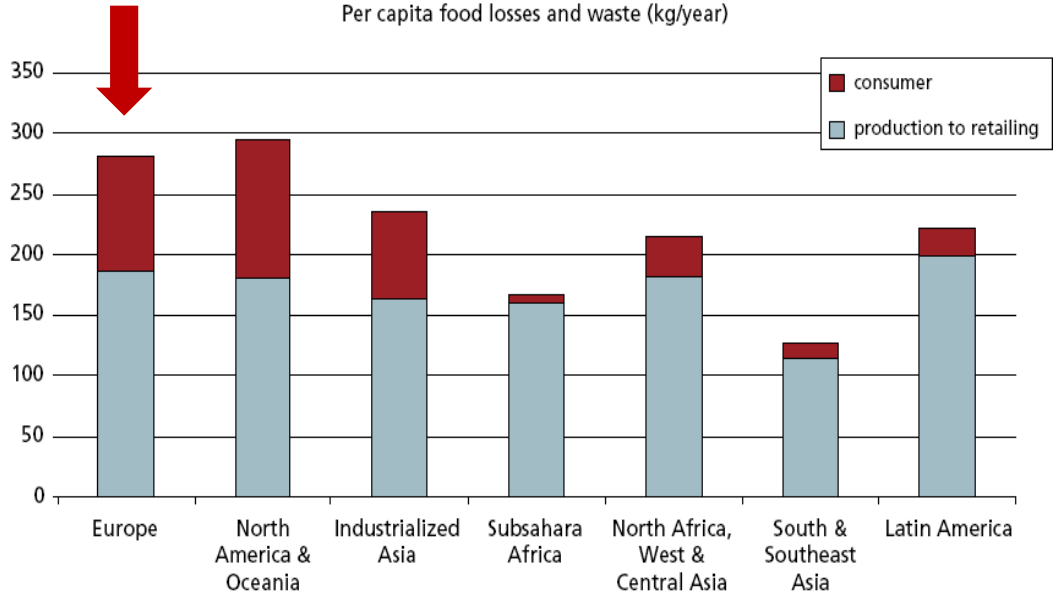


© Becoteps

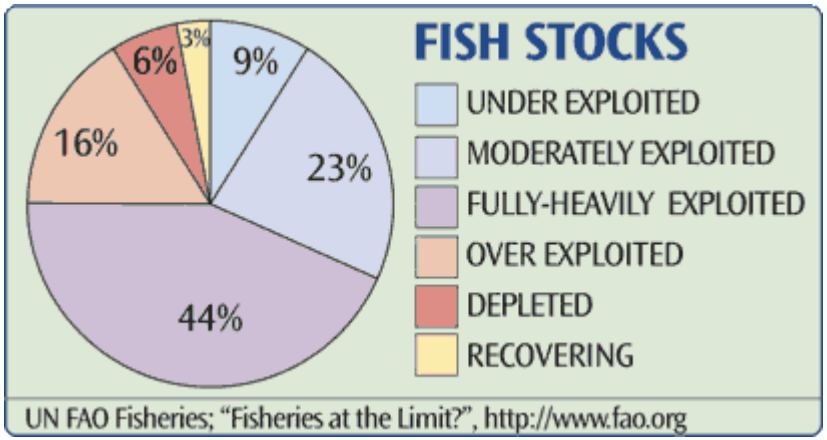
- Ensuring **food security**
- Managing **natural resources sustainably**
- Reducing **dependence on non-renewable resour**
- Mitigating and adapting to **climate change**
- Supporting **new bio-based industries,** producing **new bio-based products** and **greening the industry**
- Creating **jobs,** maintaining **EU competitiveness** and boosting **sustainable growth**
- **Crosscutting nature**

Increasing the resilience, sustainability and productivity of food chain

Per Capita food losses and waste, at consumption and pre-consumptions stages, in different regions



Source: FAO, http://www.fao.org/fileadmin/user_upload/ags/publications/GFL_web.pdf



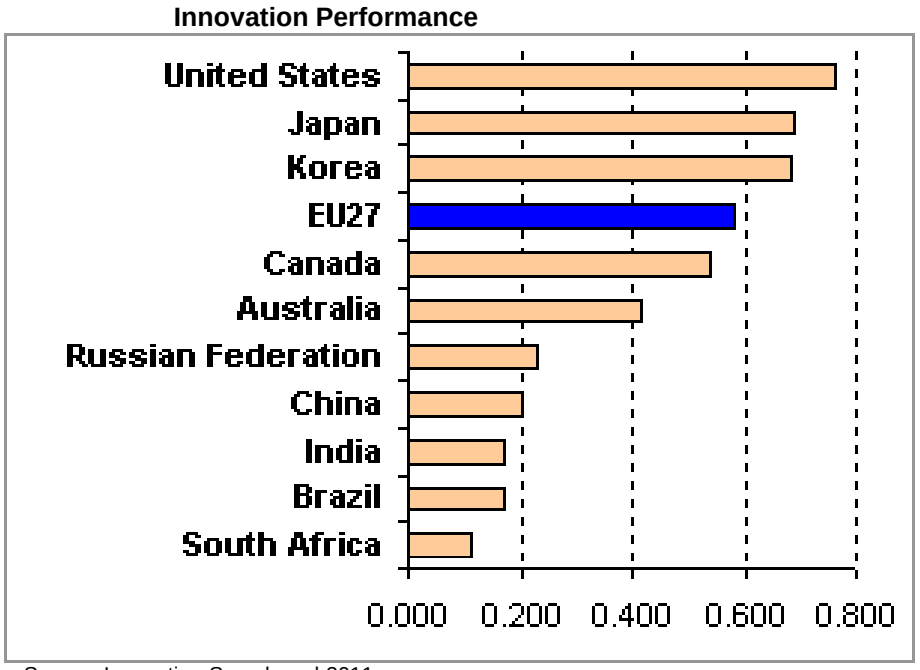
We waste

And overexploit

Building competitive Bio-based industries in Europe: Growth and jobs – innovation-driven

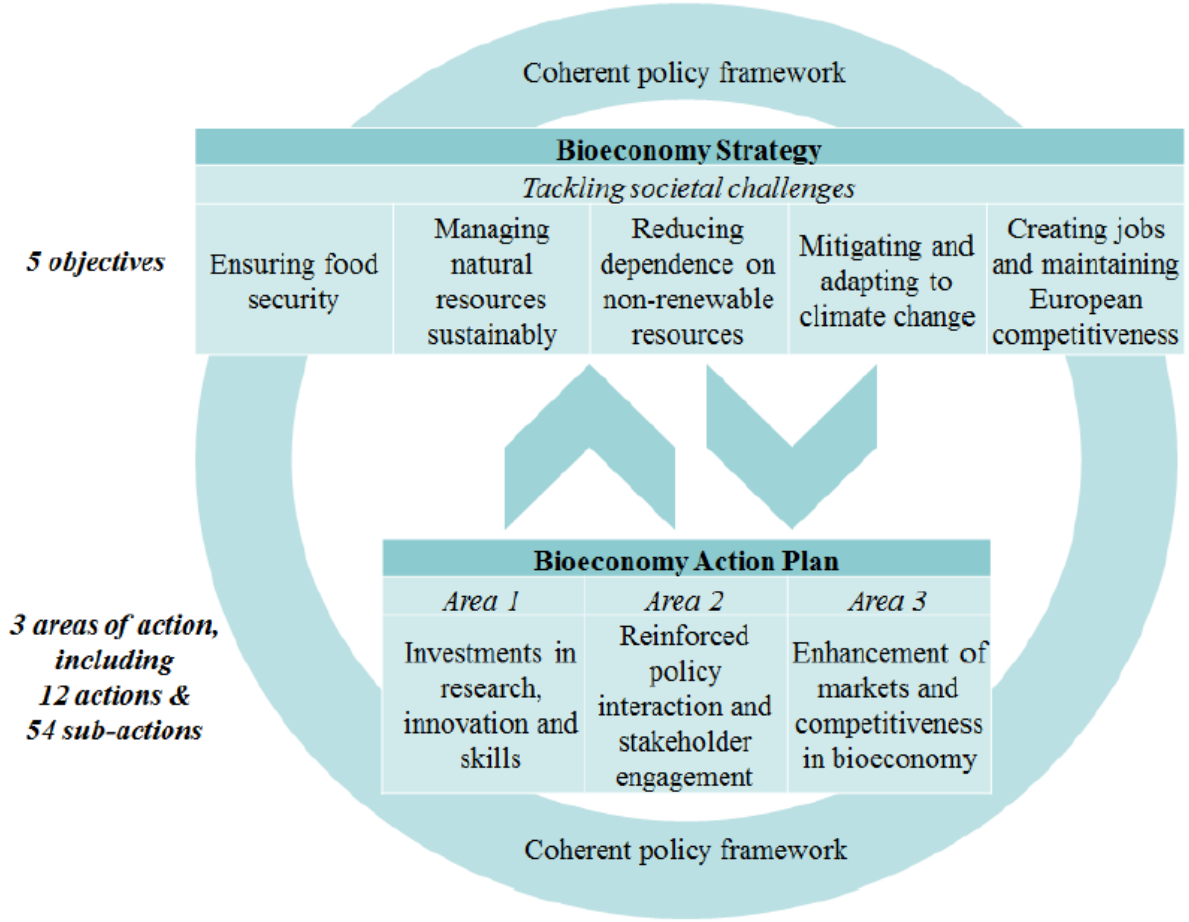
High valued-added products: **4-5 times higher potential for job creation and revenue** than the primary production.

Each euro invested in Research and Innovation in the bioeconomy sector will generate **10 euros by 2025**



Source: Innovation Scoreboard 2011.
Note: Normalised scores between 0 and 1

Bioeconomy Action Plan



Review of the EU Bioeconomy Strategy 2012

- 2017
- External Expert group

- examine the contribution of the Bioeconomy Strategy to the Circular Economy and update the Bioeconomy Strategy accordingly
- Innovation Union and Resource efficient Europe

- Review of 3 pillars

Pillar 1 - EU funding

- EU funding for the bioeconomy under the Horizon 2020 programme
  - total financial envelope for bioeconomy of EUR 4.52 billion for the period 2014-2020
  - compared to FP7, its predecessor programme (EUR 1.9 billion for 2007-2013

  - Multidisciplinary reserch
  - Bioeconomy sklil – education activities

    Bioeconomy Master Uni Hohenheim

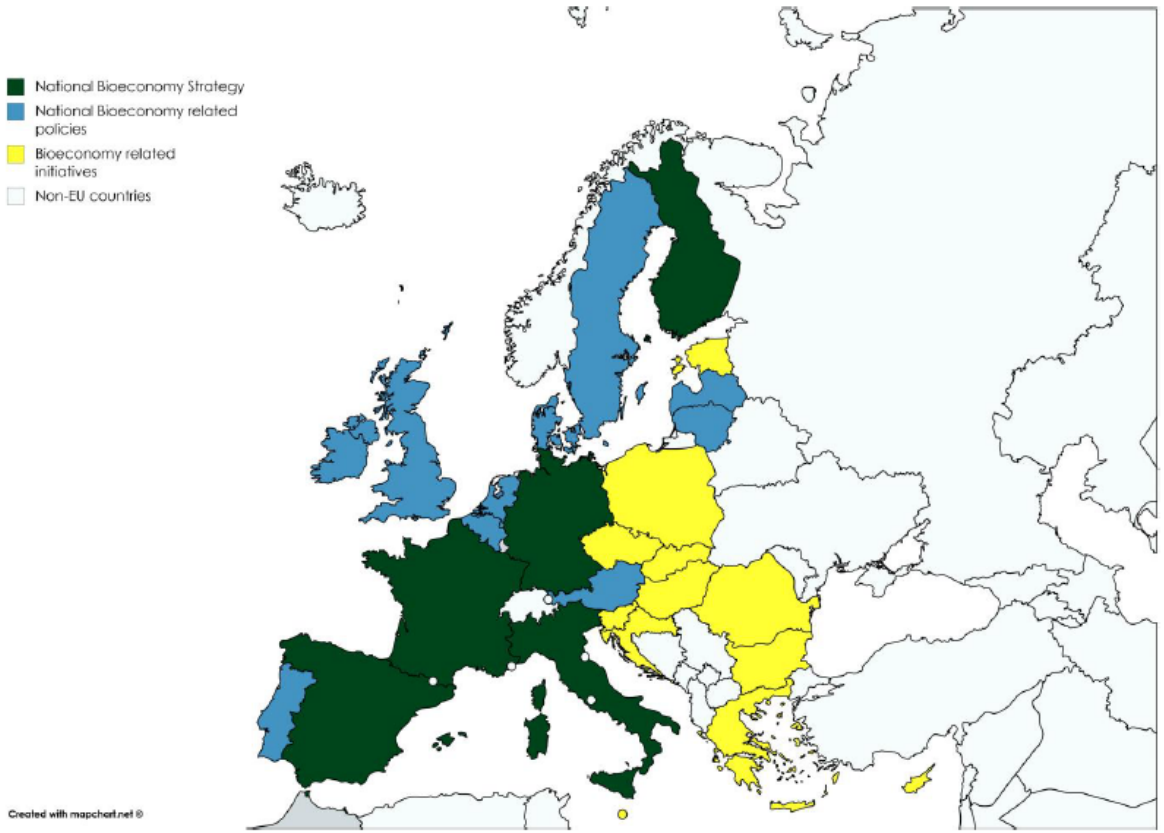
- EU structural funds – RIS3 strategies

Pillar 2 – policy integration

- Bioeconomy Panel
- Bioeconomy observatory
- National Bioeconomy strategies
- Policy coordination

EU Bioeconomy Strategies

Figure 2: Bioeconomy strategies and bioeconomy related policies in the EU



Source: European Commission, DG Research and Innovation

Pillar 3 – Enhancement of markets and competitiveness

- bio-based infrastructures and value chains – BBI JU
  - Bio-based infrastructure
  - Cascading use of biomass and waste streams
- Standards, labelling and certification schemes
- Regulatory Framework for the development of new markets
  - progress in this area has been rather slow
  - Issue of food waste use
  - Casdading use of biomass
  - Regulatory Framework of bio-based industries is rather too complex

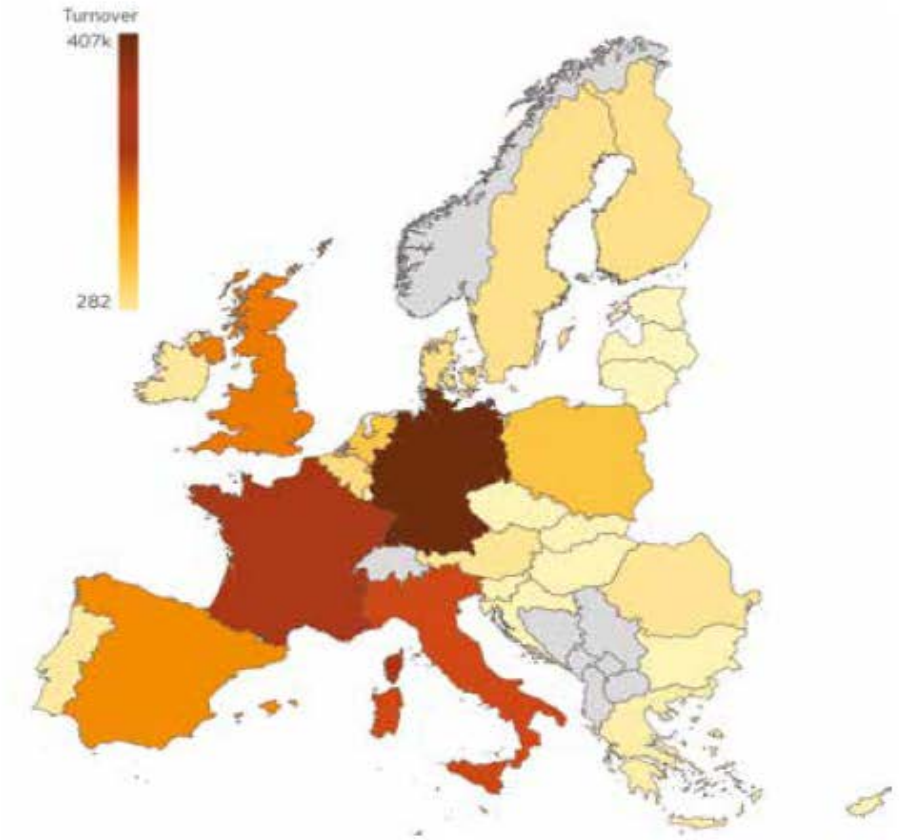
Economic effects

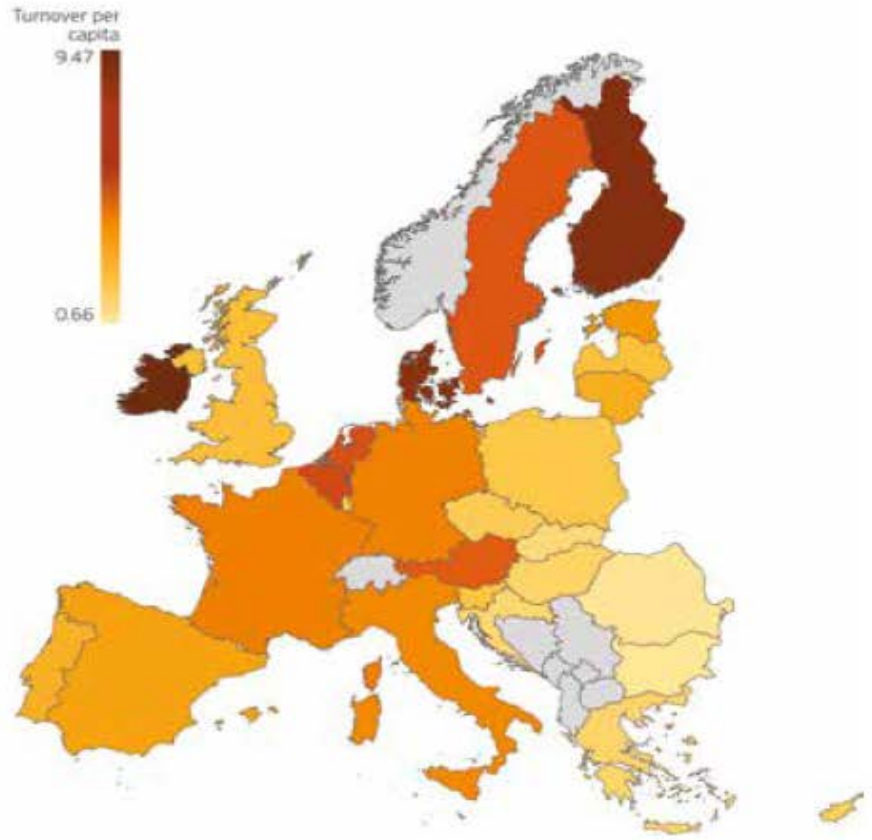
- Differencies between EU member states – contrasting picture
  - Distribution of turnover

    nearly 50 % of the total EU bioeconomy turnover was generated in only three Member States: Germany (18 %), France (15 %) and Italy (13 %)

  - Participation in research projects

Distribution of bioeconomy turnover across EU





Miscanthus

- Economic and business model
- Future projects

Biomass and bioenergy

- The worldwide share of woody biomass dedicated for energy production amounts to more than 50% of the total harvested woody biomass
  - Depletion of natural resources
  - Competition for the wood harvested

- National and transnational climate policies set targets for the share of renewables in the primary energy supply x RED II directive
- Fuel versus food debate
- Several **perennial energy crops and fast growing trees in short rotation** are considered as alternatives

Biomass and bioenergy markets

- the growth of the biofuel/-bioenergy share in the EU energy mix will heavily depend on the degree of subsidies
- This high degree of uncertainty might hinder the further development of the bioenergy sector, because this translates into lack of security for investors
- different industry associations testify to this fact
- valuable, renewable alternatives to biomass-derived energy exist and technological advances make the material use of biomass more economically attractive

Miscanthus

- One of the most important bioenergy crops

- Unique combination of
  - Unpretentiosness regarding management
  - High annual yield potential over a lifespan up to 20 years
  - C4 type of photosynthesis – only low nutrient application

- Providing environmental benefits
  - Sequestration of carbon in the soil
  - Protection against erosion
  - Removal of heavy metals
  - Protection of the biodiversity

Miscanthus – economic perspective

- Potential
  - Biomass for energy production
  - to serve as feedstock for textiles and construction materials

- Little evidence regarding its economic viability

- **Witzel and Finger** (2016) reviewed 51 studies

(University of Bonn – Institute for Food and Resource Economics)

Witzel, C.-P., Finger, R. (2016) Economic evaluation of miscanthus production. Renewable and Sustainable Energy Reviews. 53 (2016) 681 - 696

Factors influencing the adoption and profitability of Miscanthus

- **Studies**
  - Variability and uncertainty underlying the assumptions
  - Uncertainty the farmers are exposed to concerning the profitability of their investment
  - Very mixed evidence whether M. actually pays or not
- **Barriers of adoption by farmers**
  - The total lifespan of M. differs from traditional crops – long commitment of land to one single plant
  - High uncertainty with the production of M.
  - Long span between the establishment and revenues (2 – 4 years)
  - Rather high establishment costs – different numbers in the literature
-

Benefits of Miscanthus cultivtion

- **Yield** – high coefficients of variation
- **Prices**
  - Farmers are price takers
  - No reliable market price in the literature
  - No stable functioning market
  - Price assumptions stated in the literature range from 50 €/t dm to 134 €/t dm
  - Lack of reliable price data caused by the relative novelty of the crop
  - Contracts offering guarantee prices between producer and demander
  - Some studies calculate comparative break-even price including opportunity cost (forgone profit of alternative crops)

Subsidies

- M has also to compet with fossil energy carriers – M. can be competitive (Ontario, Vyn et a. 2012)
- Prices for fossil fuels are a major factor of the profitability of M.
-
- **Subsidies**
  - **Policies to promote biomass production and/or utilization are regarded as requirement to adopt M.**
  - Availability of establishment grants
  - Greening the CAP
  - Potential of M. to contribute to ecosystem services – public funding?

Follow-up projects

Horizon

- SC 2 Food: Work Programme 2014-2017:
  - Focus on food and bioenergy

- 2018 2020 chance in SC 2 Food + SC Energy

BBI JU projects

BBI JU projects

- The project will demonstrate the **environmental sustainability and economic profitability** of an **integrated biorefinery in which low input and underutilized oil crops grown in arid and marginal lands and not in competition with food nor feed**, are valorized for the extraction of vegetable oils.
- These oils will be further converted into bio-monomers (mainly pelargonic and azelaic acids) as building blocks for high added value bioproducts (biolubricants, cosmetics, bioplastics, additives) throught the integration of chemical and biotech processes

Follow-up projects

- Structural funds (EU regional policy) and national funding
  - Regional innovation strategies – study commissioned by the European Commission

- Horizon

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