



Improved political framework for bio-based economy

IFIB 2014

Genoa, 25 Sept. 2014

**Michael Carus, Physicist
(Managing Director)**

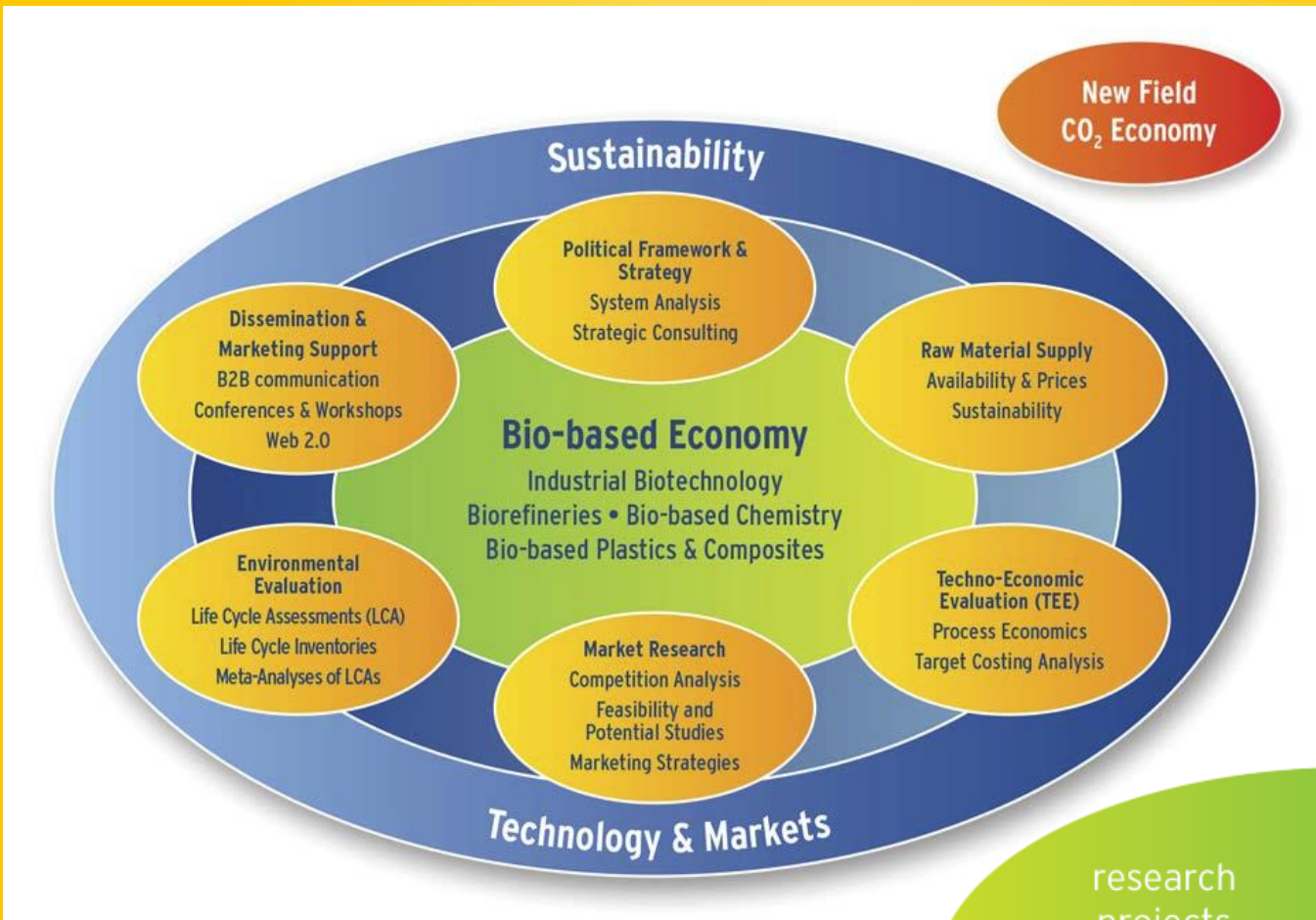
Lara Dammer, Pol. Sc.

nova-Institut GmbH, Hürth (Cologne), Germany

Bio-based Economy – Bio-based Chemistry and Materials

- Raw Material Supply
- Techno-economic Evaluation
- Market Research
- Ecological Assessments
- Dissemination
- Policy





New Field
CO₂ Economy





Facts and figures nova-Institute

- Founded 1994 as a private and independent research institute
- 20 employees – interdisciplinary, international team
- Turnover > 2 Mio. € / year
- Member of various associations & committees –
CEN/TC 411, “Bio-based Expert Group” in DG Enterprise & Industry, technical group of the “bio-based panel”, SCAR Foresight experts group and advisory board of CLIB2021
- Selected customers from industry, associations and public and political institutions:

Automotive Industry: brose, BMW, Mercedes/Daimler, Faurecia, Ford, Johnsons Controls, Quadrant

Chemistry, plastics and biomaterials: Arizona Chemical, BASF, Evonik, ESE, FKuR, Honeywell, IKEA, InfraServ, KOSCHE, LEIFHEIT, Corbion (formely: PURAC), Teijin

Engineering: Coperion, FERROSTAAL, Reifenhäuser, Uhde-Inventa Fischer

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Associations / Clusters/NGOs: AVK, CEFIC, CLIB2021, European Bioplastics, EIHA, IAR, VHI, WWF (USA)

Ministries & Institutions: BfN (DE), BMELV (DE), DBU (DE), DEFRA (UK), DECC (UK), European Commission, FAO, FNR (DE), GIZ (DE), KfW (DE), NIA (TH), UBA (DE)

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Projects funded by the European Commission

Projects within the FP7 funding programme

- **BIO-TIC** - The Industrial Biotech Research and Innovation Platforms Centre - towards Technological Innovation and solid foundations for a growing industrial biotech sector in Europe: Roadmapping for a bio-based economy, identification of hurdles and network management. (FP7-312121, 08/2012 - 07/2015)
- **FIBRA** - EU-China Partnering on fibre crops: Network management, socio-economic and ecological assessment for the development of the natural fibre industry in China. (FP7-311965, 09/2012 - 11/2015)
- **KBBPPS** - Knowledge Based Bio-based Products' Pre-Standardization: Development of a standardization of bio-based products, network management and dissemination. (FP7-312060, 08/2012 - 07/2015)
- **MultiHemp** - Multipurpose Hemp: Techno-economic evaluation, life-cycle assessment (LCA) and dissemination for the development of a multipurpose hemp. (FP7-311849, 09/2012 - 02/2017)
- **SPLASH** - Sustainable Polymers from Algae Sugars and Hydrocarbons: Dissemination for a multinational project on algae biotechnology and product development. (FP7-311956, 09/2012 - 09/2016)
- **MIRACLES** - Multi-product Integrated bioRefinery of Algae: from Carbon dioxide and Light Energy to high-value Specialties (FP7-613588, 11/2013 - 10/2017)
- **Open-Bio** - Opening bio-based markets via standards, labelling and procurement (FP7-613677, 11/2013 - 10/2016)
- **IB2 Market** - Bringing innovative industrial biotechnology research to the market (FP7-613937, 12/2013 - 11/2015)
- **BIO-QED** - Quod Erat Demonstrandum: Large scale demonstration for the bio-based bulk chemicals BDO and IA aiming at cost reduction and improved sustainability. (FP7613941, 01/201 - 12/2017)

Projects within the WoodWisdom-Net Research Programme and ERA-NET Bioenergy


- **BIOFOAMBARK** - Bark Valorization into insulating Foams and Bioenergy: Techno-economic evaluation, market penetration strategy and dissemination (FP7-ERANET-20008-RTD, 02/2012 - 02/2015)

National projects

- **Material use of lignocellulose-containing fermentation residues from biogas production for the wood panel industry:** Project management, techno-economic and ecological assessment for the use of fermentation residues. (Funded by the Deutsche Bundesstiftung Umwelt DBU Az.28691-34, 04/2012 - 10/2014)
- **Sustainable biomass potential for biofuels in competition to food, feed, bioenergy and industrial material use in Germany, Europe and worldwide.** (Funded by the Federal Ministry of Food and Agriculture (BMEL), KZ 22501112, 04/2013 - 09/2014)
- **More resource efficiency through cascading use of biomass - from theory to practice:** Best practice analysis of existing cascades and development of recommendations for political and industrial stakeholders. (Funded by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), FKZ: 3713 44 100, 07/2013 - 10/2016)

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CONFERENCES

▶ **Vom Gärprodukt zum Holzwerkstoff – eine innovative Verwendung von Gärprodukten**

Maternushaus, Cologne, 9 September 2014

▶ **3rd Conference on Carbon Dioxide as Feedstock for Chemistry and Polymers**

Haus der Technik, Essen, 2 – 3 December 2014

▶ **SusPack 2015 – Conference on sustainable packaging – in framework with the Anuga FoodTec**

Koelnmesse, Cologne, Expected date: March 2015

▶ **8th International Conference on Bio-based Materials (“Biowerkstoff-Kongress”)**

Maternushaus, Cologne, 13 - 15 April 2015

3rd Conference on CO₂ | Carbon Dioxide as Feedstock for Chemistry and Polymers

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Dominik Vogt
Chemiepark
Knapsack
Industriestr. 300

50354 Huerth / Germany

Tel.: +49(0)2233-48-1449

dominik.vogt@nova-institut.de

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3rd Conference on Carbon Dioxide as Feedstock for Chemistry and Polymers:

2 - 3 December 2014, Haus der Technik, Essen, Germany

Carbon Dioxide – raw material of the future

NEW Newsticker on Carbon Capture and Utilization!
Free Access: www.co2-chemistry.eu/news

A new paradigm for the industrial chemical production has arisen over the last few years: the CO₂

economy. According to this vision, CO₂ is no longer seen as a waste product with dangerous environmental effects but increasingly as a feedstock for chemicals, fuels or polymers. This vision has been gaining momentum and is now emerging from the research laboratories as a serious alternative path to securing the constant supply of carbon atoms the industrial chemistry sector will continue to need for their production cycles, even in a world where fossil resources are completely depleted.

For the 3rd year in a row, the conference "CO₂ as chemical feedstock - a challenge for sustainable chemistry" will concentrate on this topic. It will be held on 2 - 3 December 2014 in the "Haus der Technik" in Essen, Germany and will be the biggest event on Carbon Capture and Utilization (CCU) in 2014. More than 300 participants from the leading industrial and academic players in CO₂ utilization are expected to attend the conference and share their recent success stories, as well as new ideas and products in realization.

Our participants

Attending this conference will be invaluable for businessmen and academics who wish to get a full picture of how this new and exciting scenario is unfolding, as well as providing an opportunity to meet the right business or academic partners for future alliances.

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Take the extraordinary opportunity to present your company and your innovative products at the conference with an exhibition booth!

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6 November 2013

Einigung im Streit um EU-Zuschüsse: Mehr Geld für kleine und mittlere Höfe
Agrarminister wollen künftig 4,5 Prozent der Direktzahlungen in die zweite Säule umleiten

Environment: Commission proposes to reduce the use of plastic bags
Extensive public consultations found broad support for an EU-wide initiative

Ruanda: Tüten mitbringen verboten
Seit 5 Jahren macht ein kleiner afrikanischer Staat es uns vor: "Wir sind sehr stolz auf das, was wir erreicht haben."

European Commission's proposal to reduce consumption of plastic bags an important opportunity to promote bioplastic alternatives
European Bioplastics promoting measures for bioplastic alternatives in Member States

Vorschlag der EU-Kommission zur Reduktion des Konsums von Kunststofftragetaschen eröffnet Fördermöglichkeiten für Biokunststoffe
European Bioplastics: den Mitgliedsstaaten sollte Flexibilität beim Umstieg auf Biokunststoff-Taschen zugestanden werden

Furfural: Science Behind Rockets
First furaline liquid propellant rocket engine (LPRE) was unveiled for an anti-aircraft missile

BCC Research publishes a new report on global markets for biodegradable polymers
Global volume for biodegradable polymers rises to 1.5 billion lbs by 2014 and expected to reach 3 bln lbs by 2019 at a CAGR of 10,4%

5 November 2013

TOP CO₂: a renewable feedstock
Chemical industry use of CO₂ as a renewable resource can support EU chemical sector sustainable development and future competitiveness, says Cefic innovation head Gernot Klotz...

Issaquah, Wash., voters to decide fate of plastic bag ban
Special election will cost the city between \$45,000 and \$49,800, according to an analyst

Rare earths in bacteria
Methane-decomposing bacteria from hot springs need the valuable metals to produce energy

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NEWSLETTER

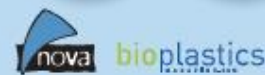
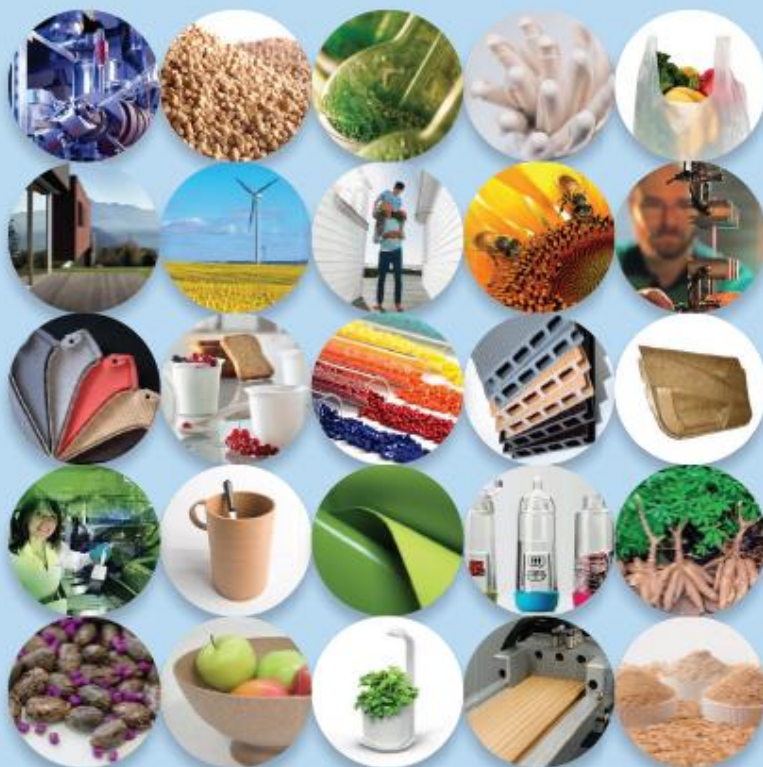


5th edition



iBIB2014/15

International Business Directory for Innovative Bio-based Materials



Published by nova-Institut GmbH and bioplastics MAGAZINE



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- Bio-based Plastics for durable applications
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- Wood Plastic Composites and other Cellulose-reinforced plastics
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- CO₂ based
- Certification
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- Colours / Pigments
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- Flame retardant
- Impact modifiers
- Plasticizer
- Processing aid
- Protection against biological infestation
- Stabilizers
- Other

Special Properties

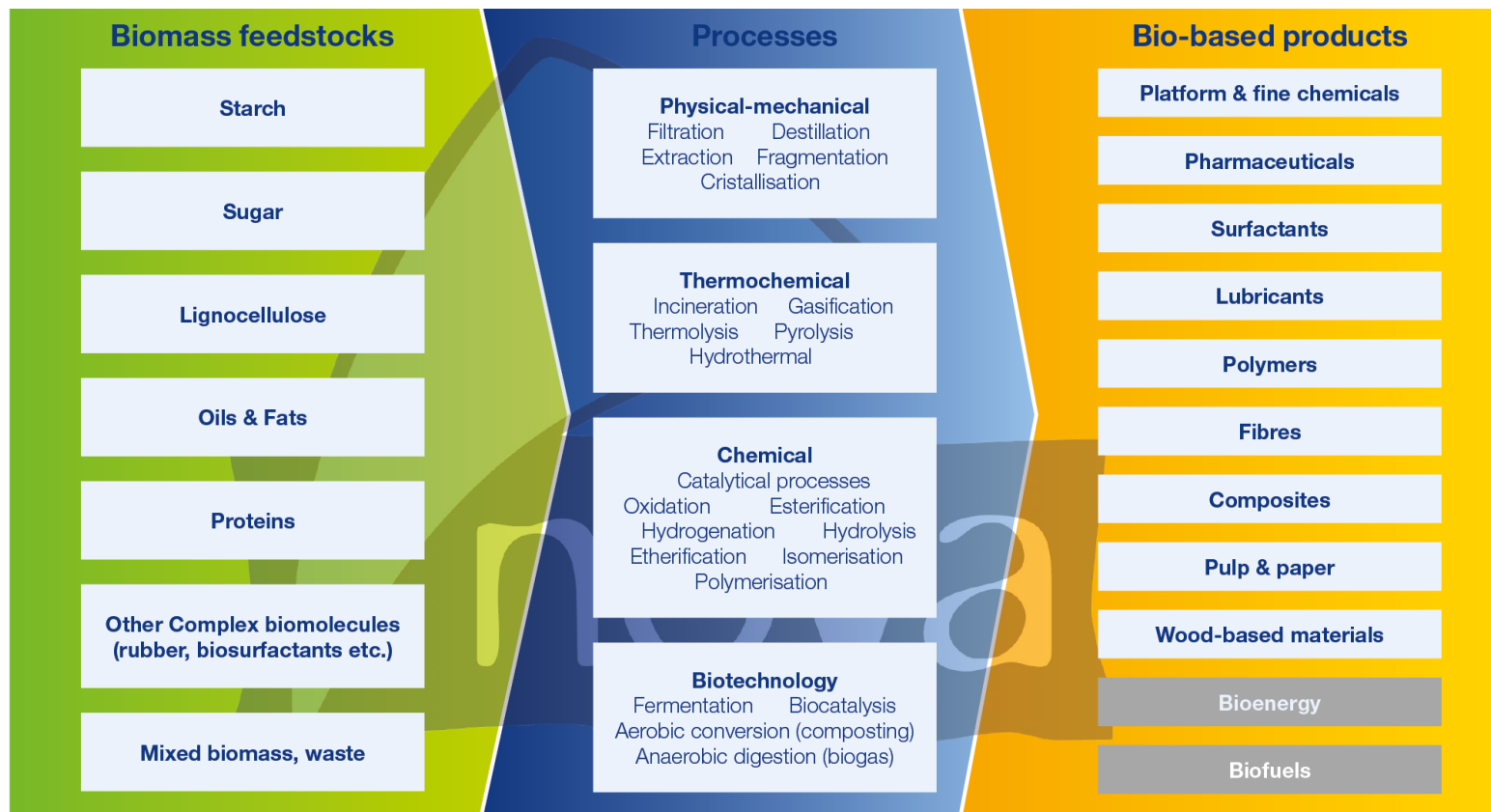
- Antistatic
- Breathability
- Bio-degradable (DIN EN 14851/2)
- Compostable (DIN EN 13432)
- Flame retardant

Suppliers, Engineering, Associations and Agencies, R&D, Certifiers and Consultants of the iBIB2014/15



Bio-based economy

Bio-based Economy: feedstocks, processes and products (without food & feed)

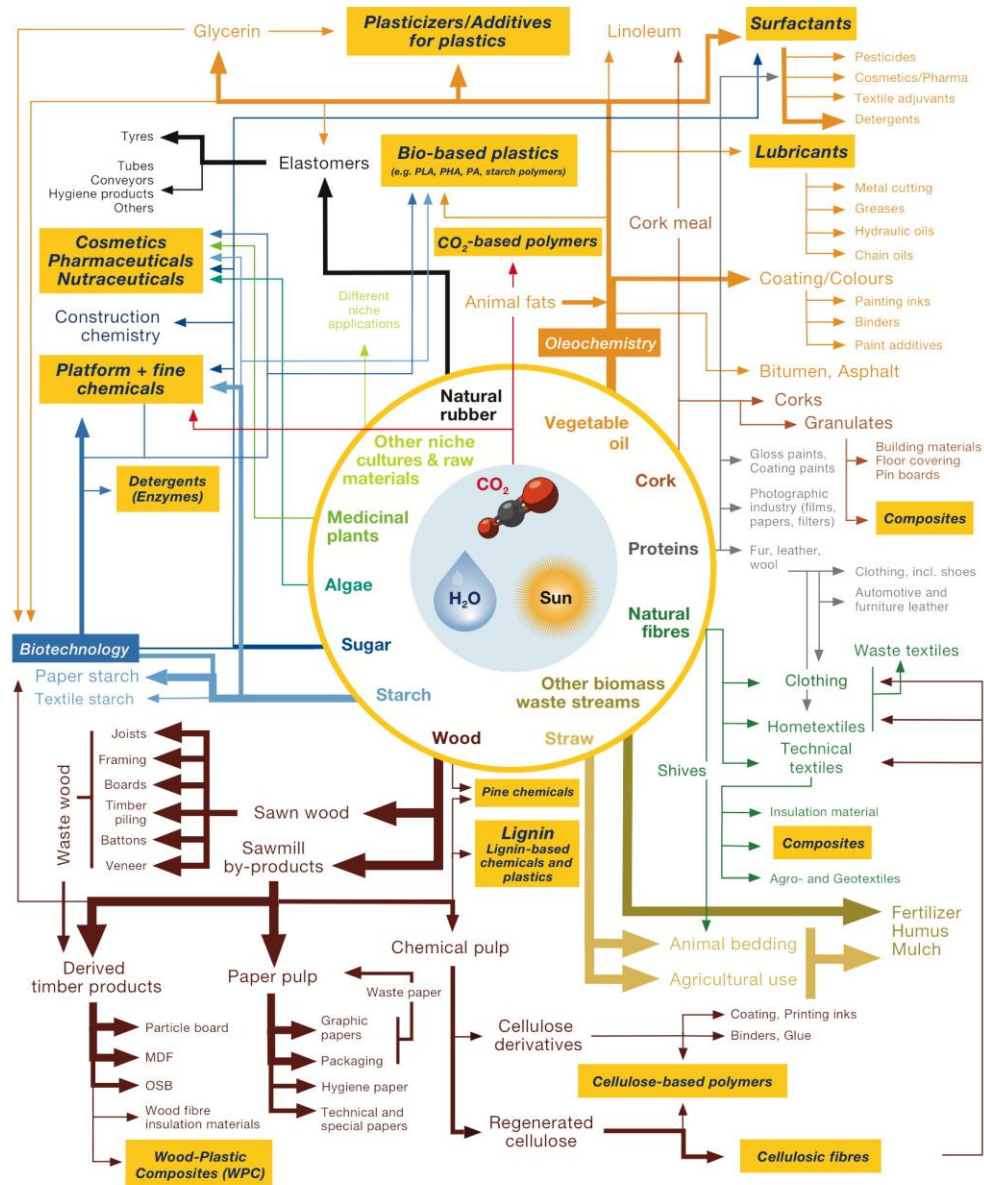




Industrial material use covers a range of industries

In 'material use' biomass serves as a raw material for the production of all kinds of goods, as well as their direct use in products. This distinguishes it from energy use, where biomass serves purely as an energy source, and the use for food and feed purposes.

(Carus et al. 2010)



Use of biomass in the EU-27 2010 (domestic and imported)

	Industrial material use	Bioenergy, incl. electricity, heat, biofuels and biogas
Agricultural biomass	30 Million t*	40 Million t**
Wood	230 Million t***	170 Million t***

* source: estimations by nova-institute based on USDA 2011 and data from Germany, adapted to EU-27
 ** source: USDA 2011 and estimations by nova-institute
 *** source: Merlau et al. 2010





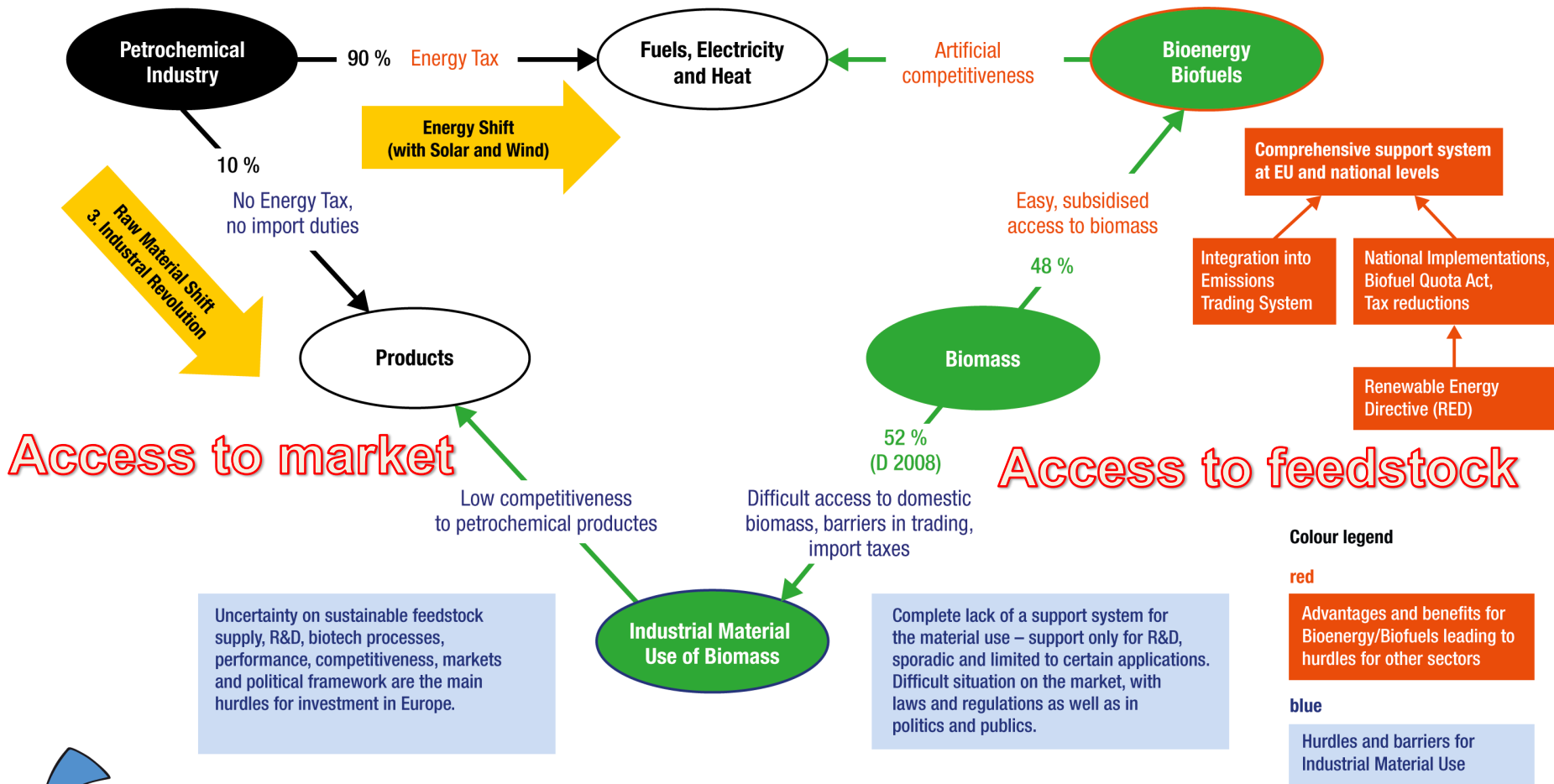
The Existing Bioenergy and Biofuel Policy in the EU is a Hurdle for Bio-based Economy

**New Policy Needed:
Level Playing Field for Bio-based
Chemistry and Materials**



The competition triangle:

No level playing field for bio-based chemicals and products





Main European Policy Instruments on non-food/feed biomass use

Instruments	Biofuels	Biogas for Electricity	Wood-Pellets for incineration	Material Use, bio-based products
Tax reduction	Yes	(Yes)	Yes	No
Quota (Biofuel, Renewable Directive)	Yes	Yes	Yes	No
Green Feed-In Tariff for Electricity (& Heat)	Yes	Yes	Yes	-
Emission Trade System (ETS)	Yes	Yes	Yes	No
Market Introduction programs	Yes	Yes	Yes	(Yes) (few selected sectors only, limited time)
Others (rural development supporting schemes)	Yes	Yes	Yes	No (new CAP: Yes)
Research & Development	Yes	Yes	Yes	Yes



Amount of support, Germany 2009 – 2013

	Share of the price support compared to revenue		
	2009	2012	2013
Biodiesel (Rape)			
Pure fuel	20-35%	19-20%	ca. 2%
Addition (quota), real	20-60%	24-41%	24-41%
Addition (quota), max.	50-80%	53-58%	53-58%
Vegetable oil fuels (Rape)			
Pure fuel	20-35%	19-20%	ca. 2%
Bioethanol			
From cereals			
Pure fuel	ca. 45%	ca. 42%	ca. 42%
Addition (quota), real	50-85%	39-52%	39-52%
Addition (quota), max.	70-90%	64-70%	64-70%
From sugar beets			
Pure fuel	ca. 45%	ca. 42%	ca. 42%
Addition (quota), real	50-85%	39-52%	39-52%
Addition (quota), max.	70-90%	64-70%	64-70%
BtL	n.a.	n.a.	n.a.
Biogas (60% maize, 40% manure)	40-80%	60-80%	60-80%
Photovoltaics green field plant	70-90%	58-78%	54-76%



The impacts

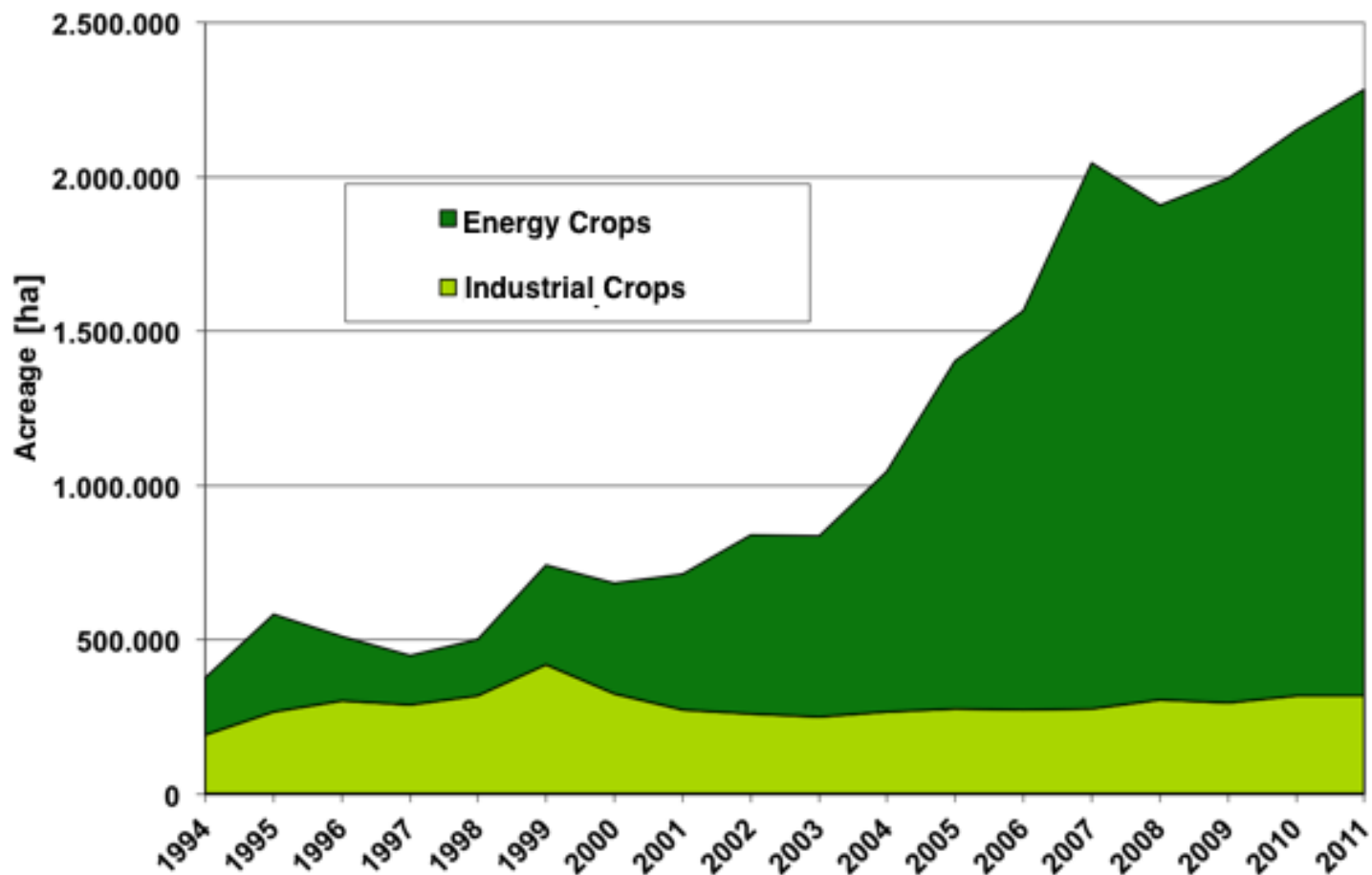
- Increasing prices for biomass
- Increasing land prices
- Insecure availability for other sectors
- The battle for biomass is lost for the material sector: If a raw material is covered by the bioenergy/biofuel support, it is lost for the material sector. The energy sector can just pay more for the raw material - due to subsidies only.
- Hundreds of potential biomass applications in the industrial material sector – like bio-based chemicals and materials are – are not realised!

**Insecure environment and political framework for the industry:
Low investment in bio-based economy in Europe.**



Renewable Resources in Germany

Material use – stagnation and decrease despite of priority status



Source: FNR 2012



The EU will need a new political framework for rolling out its bio-based economy latest by 2020. The existing framework does not create sufficient market pull for implementing innovative, bio-based technologies.

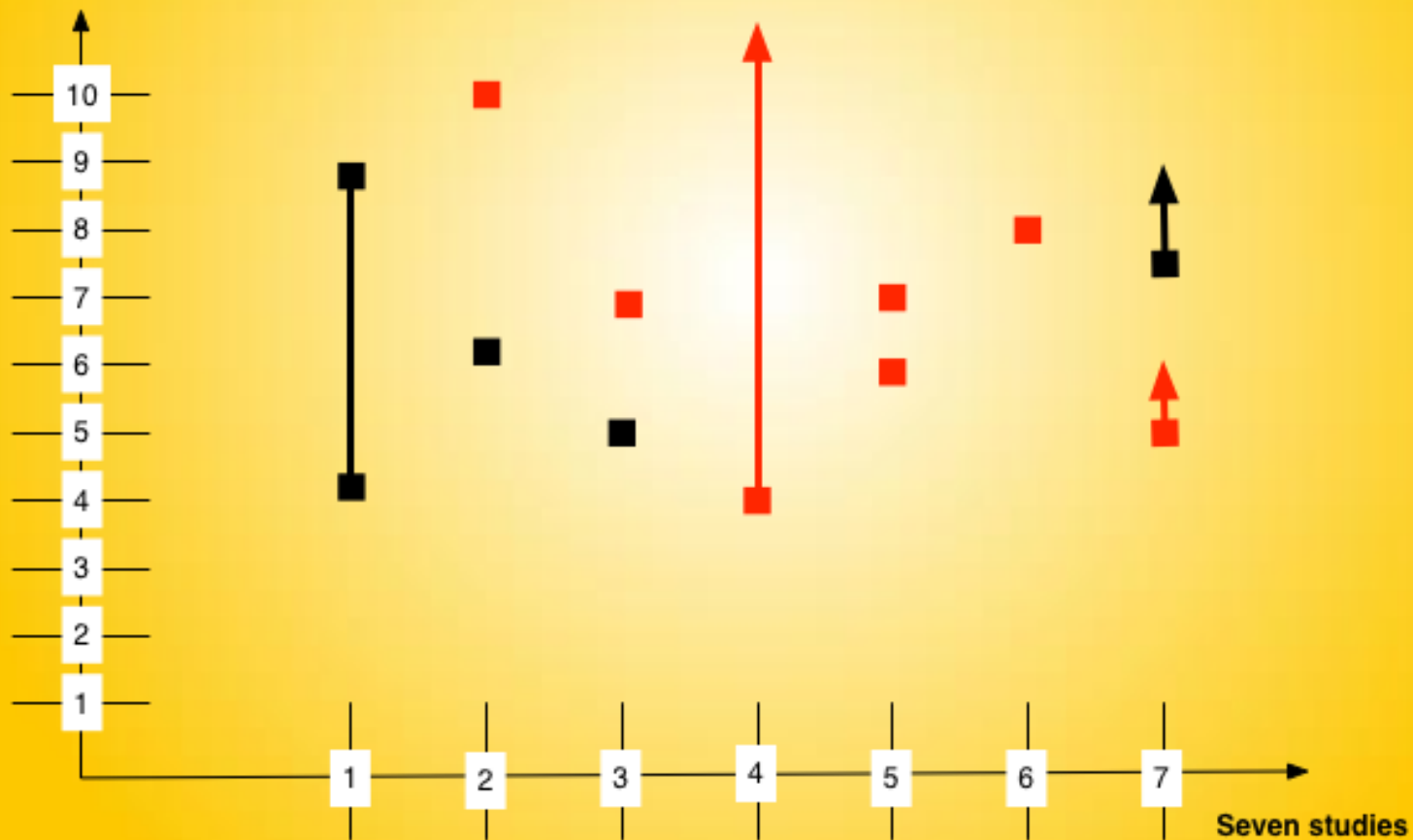
The best framework would allow for the highest resource efficiency, the most innovation capacity, the highest value added, the most employment and the greatest protection of ecosystems.



The factors state how much more gross employment and added value is created per unit of land (or tonne of biomass) by material use than by energy use

Direct gross employment factor

Direct gross added value factor





The **current framework** creates a non-level playing field between bio-based materials and energy, triggers never-ending discussions about a variety of issues such as land-use change and multiple counting of different biomass sources in quotas, and ultimately hinders Europe's bio-based economy from tapping into its full potential of innovation, investment and jobs. There are several ways to change this framework.

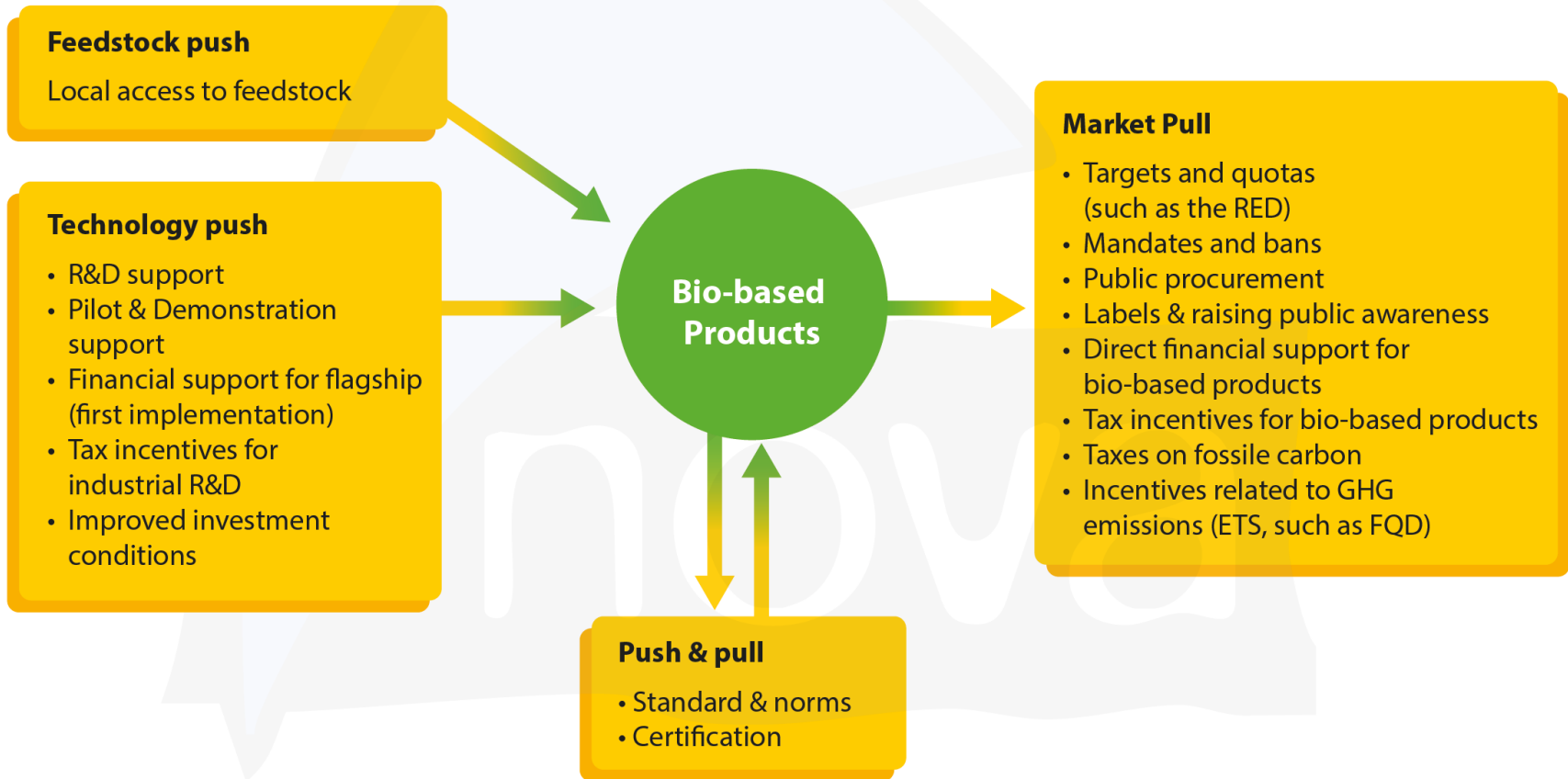
The whole bioenergy and biofuel sector is strongly dependent on incentives. If those are reduced, many companies might face bankruptcy and new investments will stop – as can already be witnessed in many member states.



Improved political framework for bio-based economy

Which options we have?

Instruments to strengthen innovation implementation by technology push and market pull (nova 2014)





Standard and norms, public procurement, Labelling (EU Ecolabel) and raising public awareness

are important for establishing a long-term market of bio-based chemicals, materials and products. However they barely help in the everyday competition for biomass and market access, **and are relatively weak instruments which are not enough to trigger large-scale effects and investment.**

A strong instrument would be to make bio-based materials and products economically attractive or even mandatory for the industry or end consumers.



Standard and norms

August 2014 the European Standard **EN 16575** came into force: A **bio-based product** is “wholly or partly derived from biomass. ... The bio-based product is normally characterised by the bio-based carbon content or the bio-based content.”

The certification of “**sustainable feedstock**” is also on the right track: established systems such as ISCC, RSB or FSC and PEFC can be used wherever it is appropriate.



nova-Institute's Recommendations 1

Keep the existing infrastructure with a substantial reform of the RED.

The existing infrastructures of bioenergy and biofuels, which are already under pressure, could be in danger after 2020. The current infrastructure is an advantage and forms the basis of the European bio-based economy. It should be used, preserved, and expanded by the transformation to bio-based chemicals and materials. To achieve this, nova-Institute recommends a substantial reform of the RED to a Renewable Energy and Material Directive (REMD) (“Level playing field”). By promoting new material applications of biomass, more value added can be created per tonnes of biomass, new investments attracted and employment generated.



nova paper

PROPOSALS FOR A REFORM OF THE RENEWABLE ENERGY DIRECTIVE (RED)

Going to the next level: Integration of bio-based chemicals and materials in the incentive scheme

The nova paper was published in May 2014 on www.bio-based.eu/nova-papers



REMD – The big step

- **The basic idea is to include material products, such as bio-based chemicals or materials, in the RED overall quotas and also in the fuel quota. This would make producing bio-based materials an additional option of fulfilling the RED quotas; it is not meant as a replacement.**
- This would involve recasting the RED as a **Renewable Energy and Material Directive (REMD)** and would live up to the RED's initial goal of reducing greenhouse gas emissions. Material uses of biomass cut greenhouse emissions by a comparable amount to biofuels, at least – per tonnes of biomass resp. per hectare, each compared to its petrochemical counterpart.
- For example, the RED quota should **count chemicals and materials made from bio-based ethanol or methane produced from certified sustainable biomass in the same way as it counts bioethanol resp. biomethane as a fuel.** Other building blocks count due to their ethanol/methane equivalence on CO₂ reduction or energy.
- Expanding the RED into a REMD would **give Member States the additional option to fulfil their target quotas with bio-based chemicals and materials** and to create the necessary conditions for their chemical and plastics industries.



nova-Institute's Recommendations 2

Use mandates and bans to create environmentally friendly innovation.

Mandates and bans should be used as strong instruments based on sound environmental and health reasons in order to tap the full positive potential of bio-based products. These market pull measures should be implemented in close coordination with a technological push in the form of support for R&D, pilot and demonstration plants and flagship investments, in order to get those technologies and products off the ground for which a sufficient market pull and demand exists.

Bio-based economy: market pull measures for bio-based products (nova-Institute September 2014)

Preliminary list – basis for discussion; more ideas and feedback welcome! (lara.dammer@nova-institut.de)

Aside from incentives for feedstock or production, it is possible to stimulate market pull in order to support bio-based products and materials. Bans and mandates for certain product groups constitute one way to create such a pull. The following list is a compilation of ideas for which bio-based product groups it would make sense to implement bans and mandates. All of the proposed measures are based on environmental or health reasons.

No.	Measure	Reason	Who / what benefits?	Notes
1	Specific market pull measures: Mandatory regulations / Directives for bio-based & biodegradable materials; bans against conventional materials	Environmental reasons	Bio-based & biodegradable materials reach new markets	
1a	Mandatory bio-based and biodegradable (in soil) materials in specific agro- and geotextiles such as mulching films, tree protection, silage films, agricultural twines, tomato clips, vineyard clips, grass nails, nails for road side construction. (Ban of others products)	Environmental reasons: To avoid plastic waste and plastic micro-particles in the environment, especially in soil and water.	Bio-based plastic films and natural fibre mulch mats & textiles, which biodegrade (fast) in soil.	
1b	Mandatory bio-based and biodegradable lubricants in environmentally sensitive contexts (chain saws, boats and ships, harvesting equipment) (ban others)	Environmental reasons: To avoid non-biodegradable / toxic lubricants to enter the environment, especially in soil and water.	Bio-based and biodegradable chain-saw lubricants (biodegradable in soil and fresh water)	
1c	Mandatory bio-based and home compostable fruit stickers – sticker materials AND adhesives (ban others)	Environmental reasons: Non-biodegradable fruit stickers cause problems in home compost; plastic micro-particles enter soil and water.	Bio-based and home compostable plastics	
1d	Ban on non-biodegradable plastic peeling particles in cosmetics and body care products (ban others)	Environmental reasons: To avoid micro-particles in the environment, especially in soil and water.	Bio-based and fast biodegradable materials (in fresh water and marine water)	
1e	Mandatory nanocellulose films for transparent envelope windows and package stickers (ban others)	Environmental reasons: Transparent plastic films in envelope windows hinder the paper recycling	Nanocellulose films	
1f	Mandatory bio-based and biodegradable body bags and urns (and other funerabilia such as coffins, body bags...).	Environmental reasons: Conventional body bags are PVC, practically mummifying deceased persons. After 30 years burial, when graves are emptied, this leads to dramatic situations.	Biodegradable plastics and biodegradable naturally reinforced composites (for example for urns or coffins)	Already mandatory in FR and NL.

No.	Measure	Reason	Who / what benefits?	Notes
1g	Mandatory use of bio-based and bio-degradable materials (cotton and cellulose in combination with biodegradable plastics for films and absorbers) for hygiene articles that are often discarded via sewage: wipes, tampons, diapers, maxi pads etc.	Environmental reasons: To avoid plastic waste and plastic micro-particles in the environment, especially in soil and water.	Biodegradable plastics and other bio-based materials that biodegrade fast in soil and water.	
1h	Mandatory use of (home)compostable plastics for coffee capsules.	Environmental reasons: Aluminium and other plastic coffee capsules pose massive littering problems; on the other hand coffee grounds serve as excellent additive for compost. Home-compostability of coffee capsules would avoid a large amount of plastic littering and improve quality of compost and soil.	Home-compostable plastics.	
1i	Mandatory use of (slowly) bioegradable plastics in marine water for fishing nets.	Environmental reasons: By-catch from floating fishing nets that are forgotten and left in the ocean pose a big threat to fish populations. If these nets were to biodegrade after a while, the threat could be reduced.	Biodegradable (in marine water) plastics	
1j	Mandatory use of biodegradable chemicals / materials for all products injected in the ground: tracking fluids, drilling muds, mining fluids...	Environmental reasons: To avoid toxic and durable chemicals in the soil.	Biodegradable chemicals.	
1k	Mandatory use of biodegradable plastics in all other plastic items that typically end up in nature (golf tees, hunting cartridges, ropes....)	Environmental reasons: To avoid plastic waste and plastic micro-particles in the environment, especially in soil and water.	Biodegradable plastics and other bio-based materials that biodegrade fast in soil and water.	
1l	Ban on non-compostable and non-biodegradable plastic bags for wrapping fruit, meat, etc. (EP 16.04.2014)	Environmental reasons, avoid plastic littering to enter soil and water.	Biodegradable plastics	EP draft: by 2019.
2	Promote Xylitol as C5 sugar alternative from trees	Health reasons: Less calories than sugar and non-cariogenic	Lignocellulosic biorefineries	

No.	Measure	Reason	Who / what benefits?	Notes
3	Market pull measures for durable bio-based plastics and other bio-based materials	Environmental reasons: Incentives to reduce the CO₂ footprint of plastics.	Creating new markets for bio-based plastics and natural fibres	
3a	Minimum bio-based share of 10% (increasing continuously) for all polymers, if bio-based drop-in polymers with identical properties exist.	Environmental reasons: Incentives to reduce the CO ₂ footprint of plastics; No technical arguments that prevent an implementation (from production to recycling)	Bio-based drop-in plastics such as bio-based PE, PP and PET	Via the Eco-Design Directive?
3b	Limits for average CO ₂ footprint per kg plastics for mass products; for example 3,0 CO ₂ equivalents per kg in the beginning, continuously lowered through the years.	Environmental reasons: Incentives to reduce the CO ₂ footprint of plastics.	Recycled plastics, best pet-rochemical plastics and a full range of bio-based plastics.	Needs clarification.
3c	End-of-life vehicle directive: one proposal is to consider the share of biomass in the materials as materially recycled regardless of how they are recovered (the green CO ₂ in the bio-based materials was absorbed by crops before and does not contribute to climate change). This could be an incentive for the automotive industry to increase use.	Environmental reasons: So far, there no incentives for bio-based products in cars, although they usually have a lower carbon footprint.	Bio-based plastics and composites, natural fibres	
3d	Construction Products Regulation: Include more specifications on wood and other bio-based construction materials as alternative to fossil materials.	Environmental reasons: Lower carbon footprint of bio-based construction materials (foams for insulation, composite material, mortar, and concrete made of vegetative aggregate particles) is not accounted for in the the Construction Products Directive, even though these products have now become sufficiently advanced to offer a real alternative. .	Woodworking industry, bio-based composites and foams, others	see LMI recommendation
3e	Insulation material: For natural fibre materials, important properties (heat transfer delay, thermal conductivity, regulation of moisture) need to be fairly covered by construction regulations, norms etc.	Environmental and health reasons: Construction industry becomes more sustainable and consumers benefit from healthier room climates.	Natural fibre industry	
3f	Include bio-based materials in construction in the Carbon Capture & Storage (CCS) programme (very good carbon storage effects of durable bio-based materials)	Environmental reasons: Climate protection through carbon storage in the next 50 to 100 years with bio-based construction materials	Durable bio-based plastics and composites in construction (window frames, tubes etc.)	



nova-Institute's Recommendations 3

No limitation of R&D activities to specific biomass and applications only.

R&D activities should be not limited to the conversion of lignocellulosic feedstocks, waste biomass and algae: research should also be conducted on the use of **sugar** beet in the chemical and plastics industry as well as the use of **rapeseed oil** in oleochemistry. Sugar is relevant because it is expected to become cheaper after 2017; rapeseed is relevant for keeping the existing infrastructure of the biodiesel industry, which is heavily under pressure, as well as biogas for electricity; **biomethane** has a relevant potential for the production of chemicals and polymers. Furthermore, the huge demand for **cellulose fibre** in textiles should not be ignored; it could be a great opportunity for the European pulp industry.



nova-Institute's Recommendations 4

Guarantee the supply security of high value industries.

Overall, every development of the political framework for the bio-based economy should guarantee the supply security of high value industries such as chemicals and materials in order to prevent them from leaving Europe and taking their value and employment with them.

The affordable access to biomass plays a crucial role in this.



Thank you for your attention!



Michael Carus, CEO

Division Head “Bio- and CO₂-based Economy”

Tel.: +49 (0) 2233 – 48 14-40

E-Mail: michael.carus@nova-institut.de



www.bio-based.eu