
CLIB 2021

# CLIB$^{2021}$ Introduction

## 23.05.2016

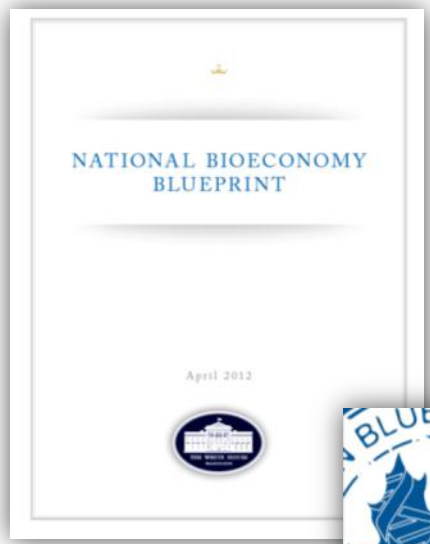
**Dr. Carolin Lange**

Bioeconomy

-

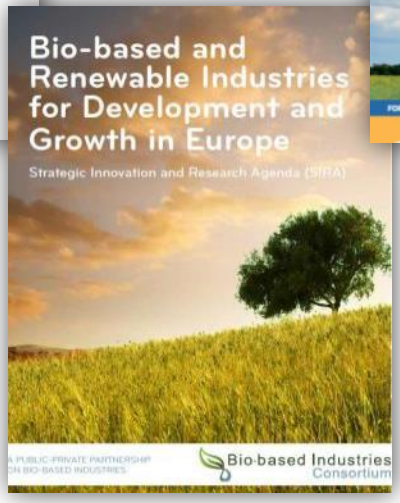
Global drivers, regional implementation

# Bioeconomy: a global trend…









# Definition Bioeconomy

Definition European Comission:

The bioeconomy comprises those parts of the economy that use renewable biological resources from land and sea – such as crops, forests, fish, animals and micro-organisms – to produce food, materials and energy.

Definition Wikipedia:

Biobased economy, bioeconomy or biotechonomy refers to all economic activity derived from scientific and research activity focused on biotechnology. In other words, understanding mechanisms and processes at the genetic and molecular levels and applying this understanding to creating or improving industrial processes.

The evolution of the biotechnology industry and its application to agriculture, health, chemical or energy industries is a classic example of bioeconomic activity.

# Definition Bioeconomy

The biobased economy uses

first-generation biomass (crops),

second-generation biomass (crop refuge),

and third-generation biomass (syngas, seaweed, algae).

# Biomass is limited

Global agro-photosynthesis
**7 bn t/a bio-carbon**

To compare:
**11 bn t/a fossil carbon**
globally consumed

**Food/Feed**

**Chemicals**

**Energy/Mobility**

# - Feedstock Focus on Ressource-Efficiency
# - Product-Focus on Chemicals & heavy-duty Fuel

Agriculture

Forestry

Waste

ind.Sidestreams

**Feedstock**

to be diversified

Cascade use

**Products**

to be prioritized

Chemicals

Long Distance Mobility

# Bioeconomy
## enters *1st gen. Food-Biomass* Markets

| *State-of-the Art* | *Just Starting* | *Emerging* |
|---|---|---|

**Sugar-/Oil-Carbon**

# Big Chemical Industries step into *1st gen.* Biochemicals

**Succinity produces first commercial quantities of biobased succinic acid**
Düsseldorf, March 3, 2014

Succinity GmbH, the joint venture between Corbion Purac and BASF for the production and commercialization of biobased succinic acid, has announced the successful start-up of its first commercial production facility. The plant, located at the Corbion Purac site in Montmeló, Spain, has an annual capacity of **10,000 metric tons...**

**BioAmber: SARNIA Construction Substantially Complete**
Sarnia, June 9, 2015

BioAmber announced today that construction of its **30,000 MT** succinic acid plant in Sarnia, Ontario is substantially complete. Commissioning is progressing as planned and the plant is on schedule to begin commercial operations in Q3 2015.

# *1st gen.* Biochemicals drive Innovation

## Clariant chooses renewable raw materials for high-performance pigments

Muttenz, April 8, 2014

- **First pigment producer to develop high-performance pigments based on bio-succinic acid**
- **Pigments based on renewable raw materials for coatings, plastics and printing sectors**
- **Supports customers' sustainability and differentiation efforts**

Clariant, a world leader in specialty chemicals, is incorporating renewable raw materials into **Quinacridone pigments** produced at its Frankfurt-Hoechst facility in Germany. The achievement makes Clariant the first pigment producer to offer high performance pigments that are based on bio-succinic acid solutions.

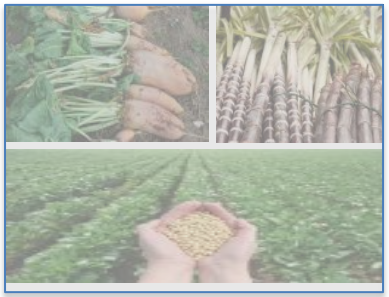
# Bioeconomy
## makes *2nd gen. non-Food-Biomass* Markets

CLIB 2021

| *State-of-the Art* | *Just Starting* | *Emerging* |
|---|---|---|

**Lignocellulosic-Carbon**


**Sugar-/Oil-Carbon**



# *2nd gen.* Ethylen to be constructed in Slovakia

**ENERGOCHEMICA SE**
**constructs a 2nd Generation Ethanol plant**

Bratislava, 06 October 2014

Biochemtex and Beta Renewables announce they have signed a definitive agreement with ENERGOCHEMICA SE for the construction of a 2nd Generation Ethanol plant and the annexed Energy Block for the generation of power and steam.
The plant, that will be built in Strazske, Slovak Republic , will deliver **55,000 metric tons per year of cost-competitive cellulosic ethanol** while using non-food biomass as its feedstock.
The project begins immediately and the start-up of the plant is expected in the first half of 2017.

# *2nd gen.* PHA to be constructed in Italy

**Italian Companies to Generate Bioplastic from Potatoe Byproducts**
Bologna, 03/18/2015

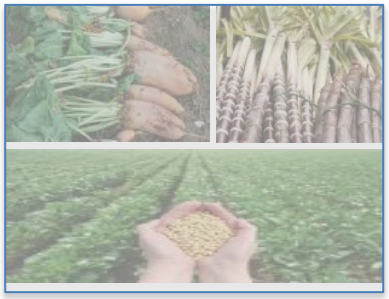
The agreement between biotech firm Bio-on and potato products company Pizzoli aims to produce 2,000 tons of bioplastics annually with the hope of doubling that capacity in the future.
The bioplastics, called **polyhydroxyalkanoates** or **PHAs**, could replace traditional plastic in a number of processes, the companies said.

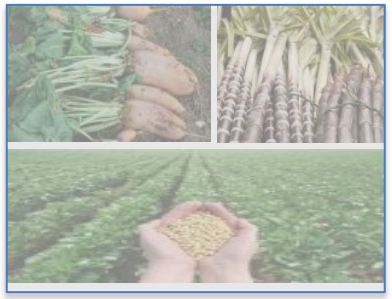
Bio-on Chairman Marco Astorri said his company's technology can already generate bioplastic from sugar beet and sugar cane byproducts, and the partnership with Pizzoli will broaden its ability to create PHAs.

# Bioeconomy
## generates *3rd gen. Recycling* Feedstock

| *State-of-the Art* | *Just Starting* | *Emerging* |
|---|---|---|
| | | $CO_2$ ,CO (Flue-, Syngas) |
| | Lignocellulosic-Carbon | |
| Sugar-/Oil-Carbon | | |





# *3rd gen.* Jet-Fuel under development from CO

**Jet Fuel from Steel-Mill off-Gas**

24.10.2014

LanzaTech is developing a revolutionary fuel that sees **waste gases from industrial steel production** being captured, fermented and then chemically converted for use as jet fuel. LanzaTech and Virgin Atlantic have been working together for three years on the fuel's development. A proving flight of the new technology will take place within the next year.

LanzaTech estimates that its process can **apply to 65 % of the world's steel mills**, allowing the fuel to be scaled up for worldwide use.

# *3rd gen.* Jet-Fuel under development from $CO_2$

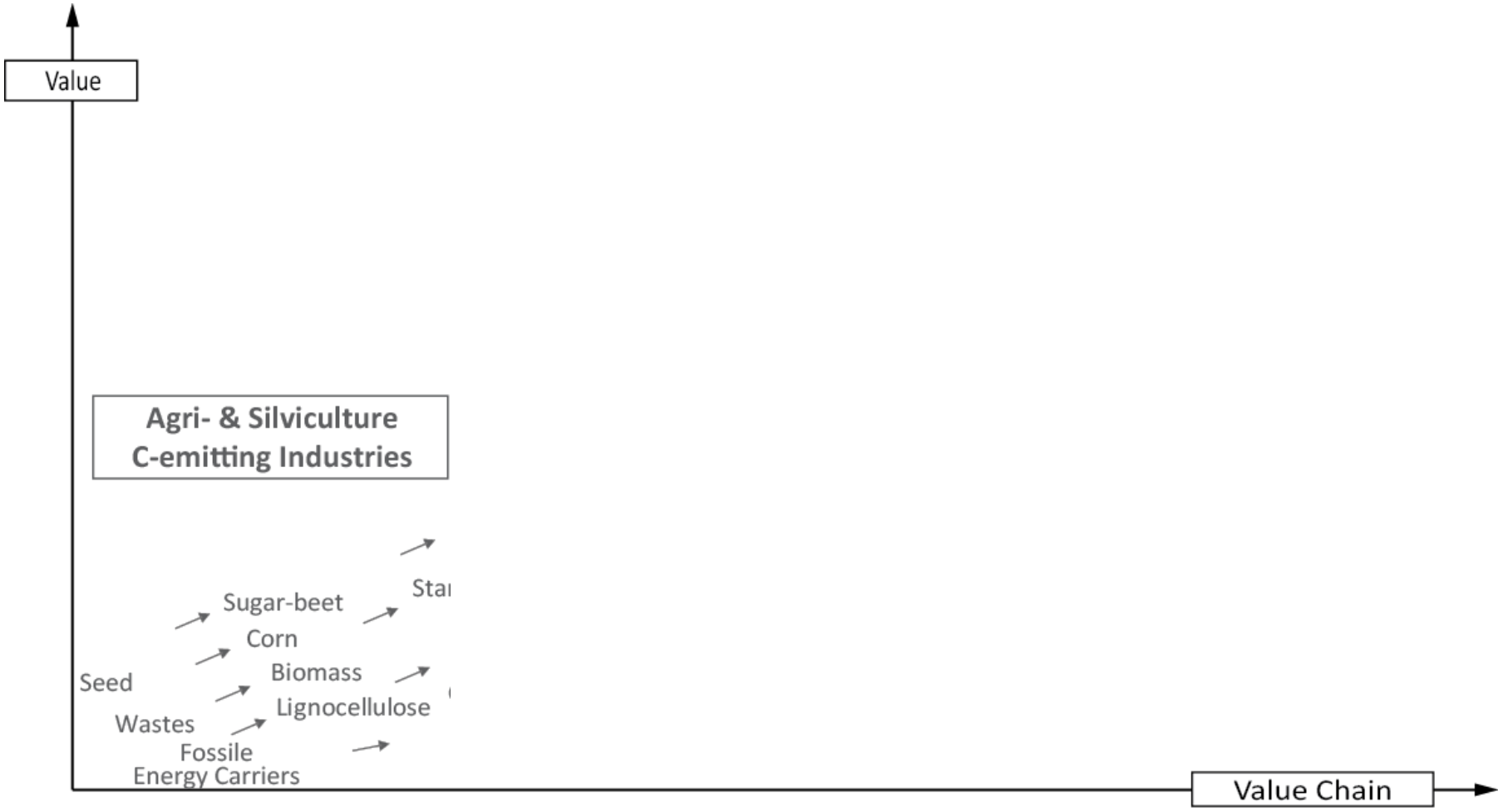
## AkzoNobel and Photanol win prestigious award

Amsterdam, 3.3.2015

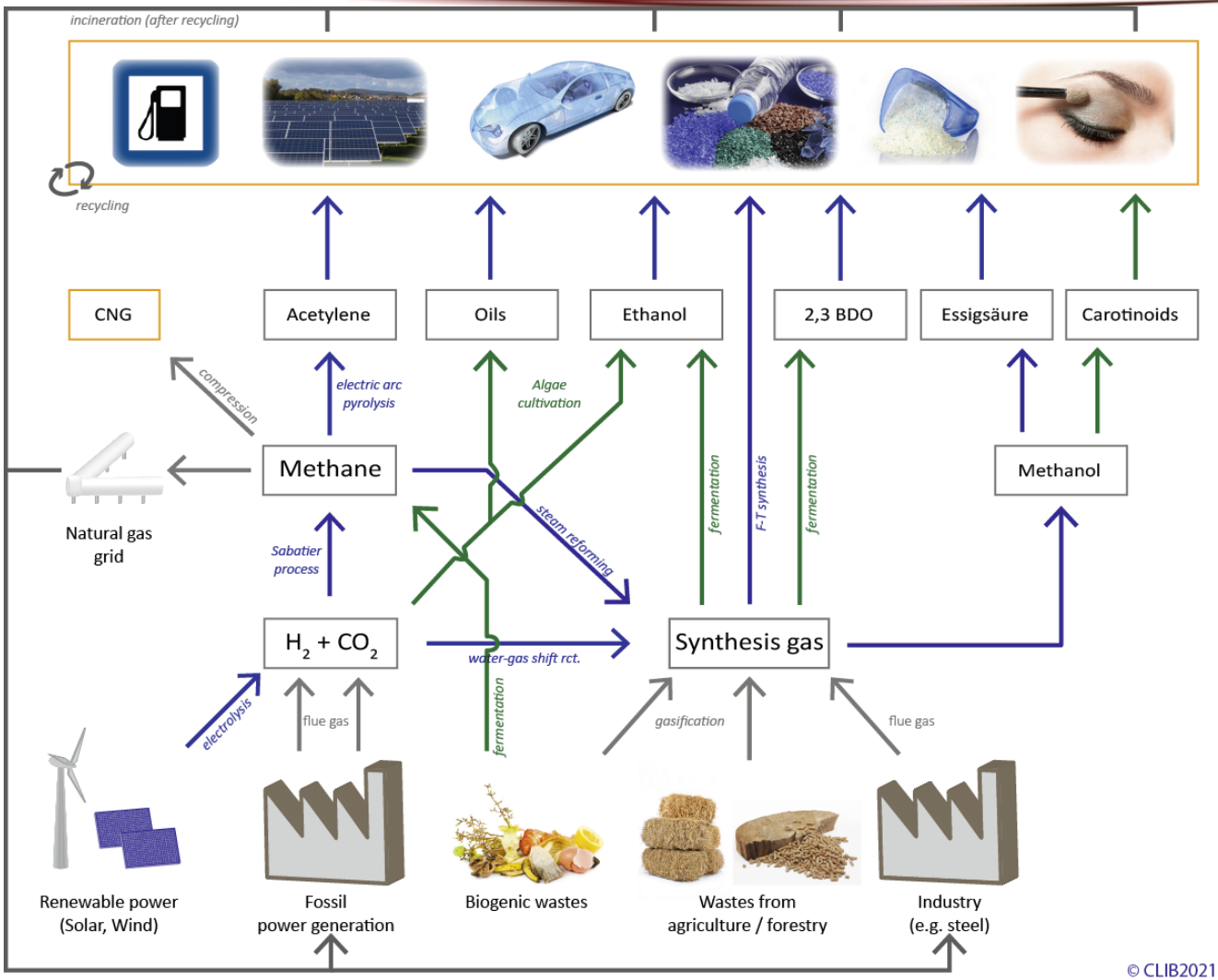
A partnership between AkzoNobel and cleantech company Photanol which aims to harness the power of the sun to make **chemicals** has won a top award at the 2015 WBM Bio Business Awards.

The prize was awarded to AkzoNobel and Photanol for their ongoing work focused on creating sustainable technology which mimics the way plants use photosynthesis. **Combining AkzoNobel's processing technology expertise and Photanol's existing proprietary technology**, the aim is to produce "green" chemical building blocks that will eventually replace some of the raw materials AkzoNobel currently obtains from fossil-based production.

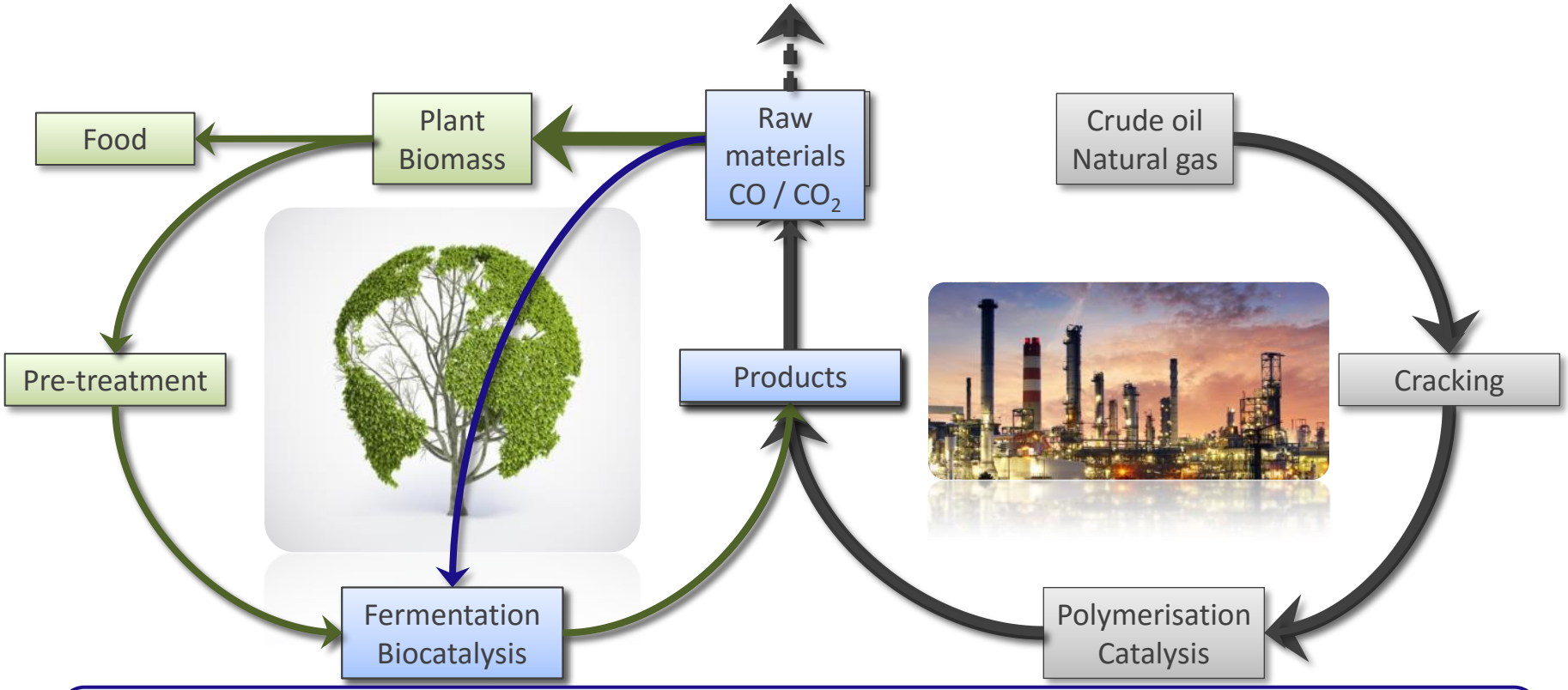
# Bioeconomy builds cross-industry partnerships



# Bioeconomy builds a link to circular economy



# Example: Carbon recycling




**Establishing circular value chains**

Independent whether biogenic or fossil – sustainability as a decisive criterion

# CLIB brings Stakeholders together to foster the Bioeconomy

# CLIB2021 - Mission and Vision

**Establish the bioeconomy and circular economy by building cross-sectorial, sustainable value chains**

- Network stakeholders in bioeconomy and circular economy
  - Policy, science, and economy
  - Cross-sectorial
  - Following value chains
- Draft innovative value chains
  - Identification and analysis
  - Support their implementation
- Educate specialists in biotechnology
  - Graduate school
  - Support cross-border education

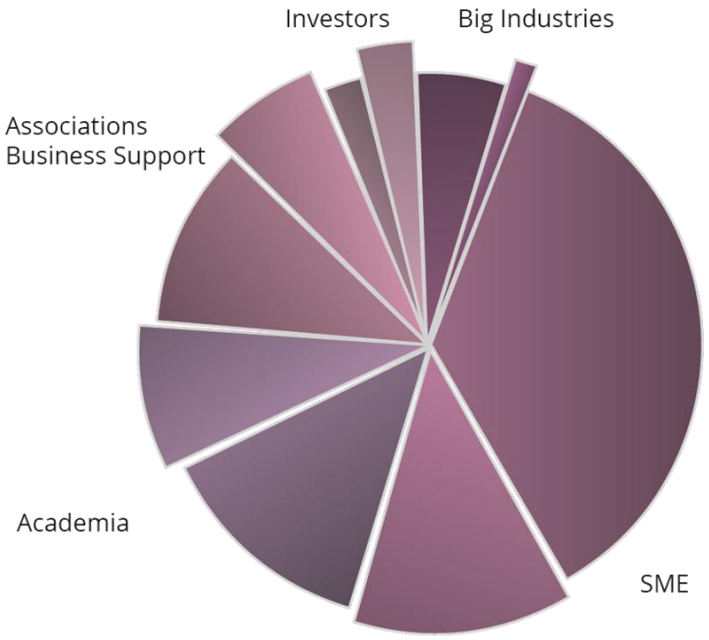
International Networking

Initiation of R&D projects

Education / Young Scientists

Support of SMEs /members

# CLIB$^{2021}$ - Overview




- Founded in 2008
- **~100 members**:
  - 50 % SME
  - 30 % International
  - > 70 bn EUR accumulated sales
- Network unites diverse stakeholders of the bio- and circular economy
- **Cross-sector network** (chemistry, energy, steel, forest, paper, plant construction, food & feed, agricultural , consumer products)
- **International network with cluster core in Germany**

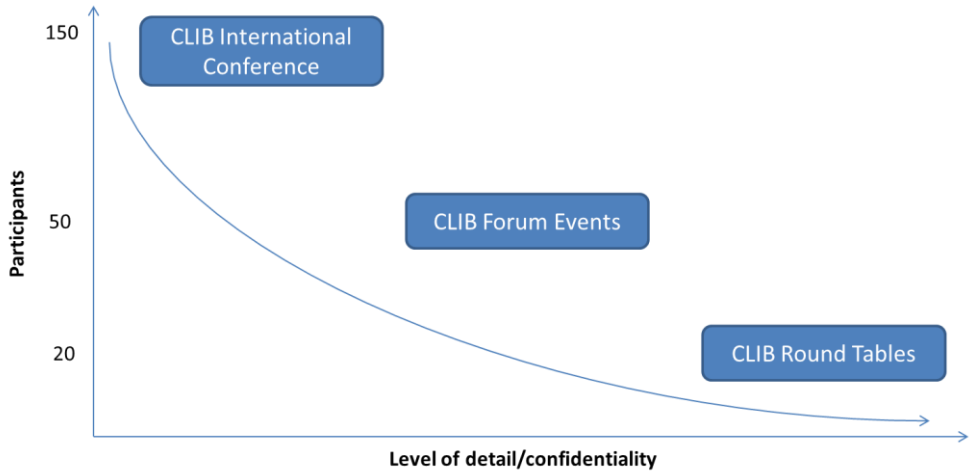
Premium partner: EVONIK INDUSTRIES

Support: Federal Ministry of Education and Research; Ministry of Innovation, Science and Research of the German State of North Rhine-Westphalia; BIO NRW Cluster Biotechnology North Rhine-Westphalia; Investing in Opportunities INTERREG IVB; HORIZON 2020

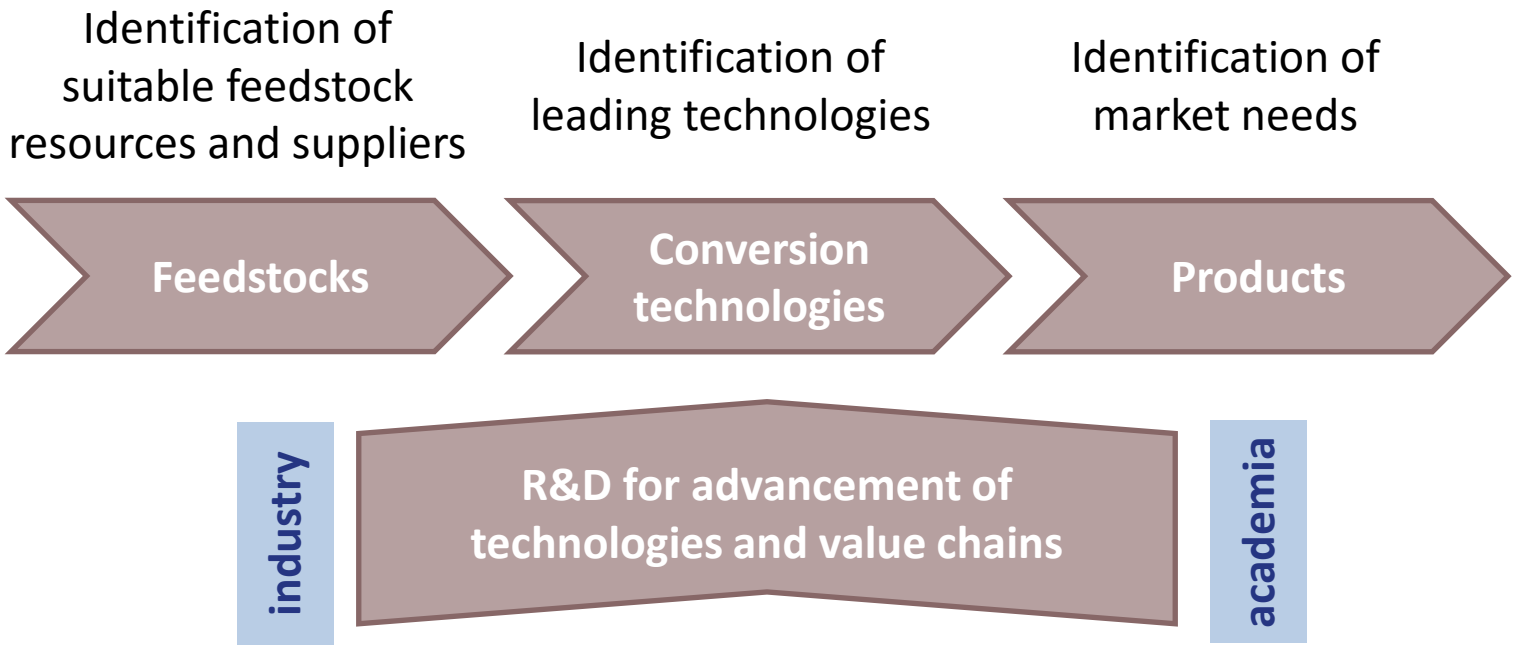
# CLIB: networking consortia, supporting projects, turning results into business practice

- Strong established German and international network in industrial biotechnology/bioeconomy
  - Access to experts, technology drivers, researchers
- Policy advisor in German political landscape
- Competence in projects:
  - Dissemination
  - SME support
  - Business exploitation of project results:
    - Technology scouting/transfer
    - Patenting advice
    - Start-up mentoring

- Structured networking approach
  - From scouting trends to confidential meetings
  - From ideas to project consortia

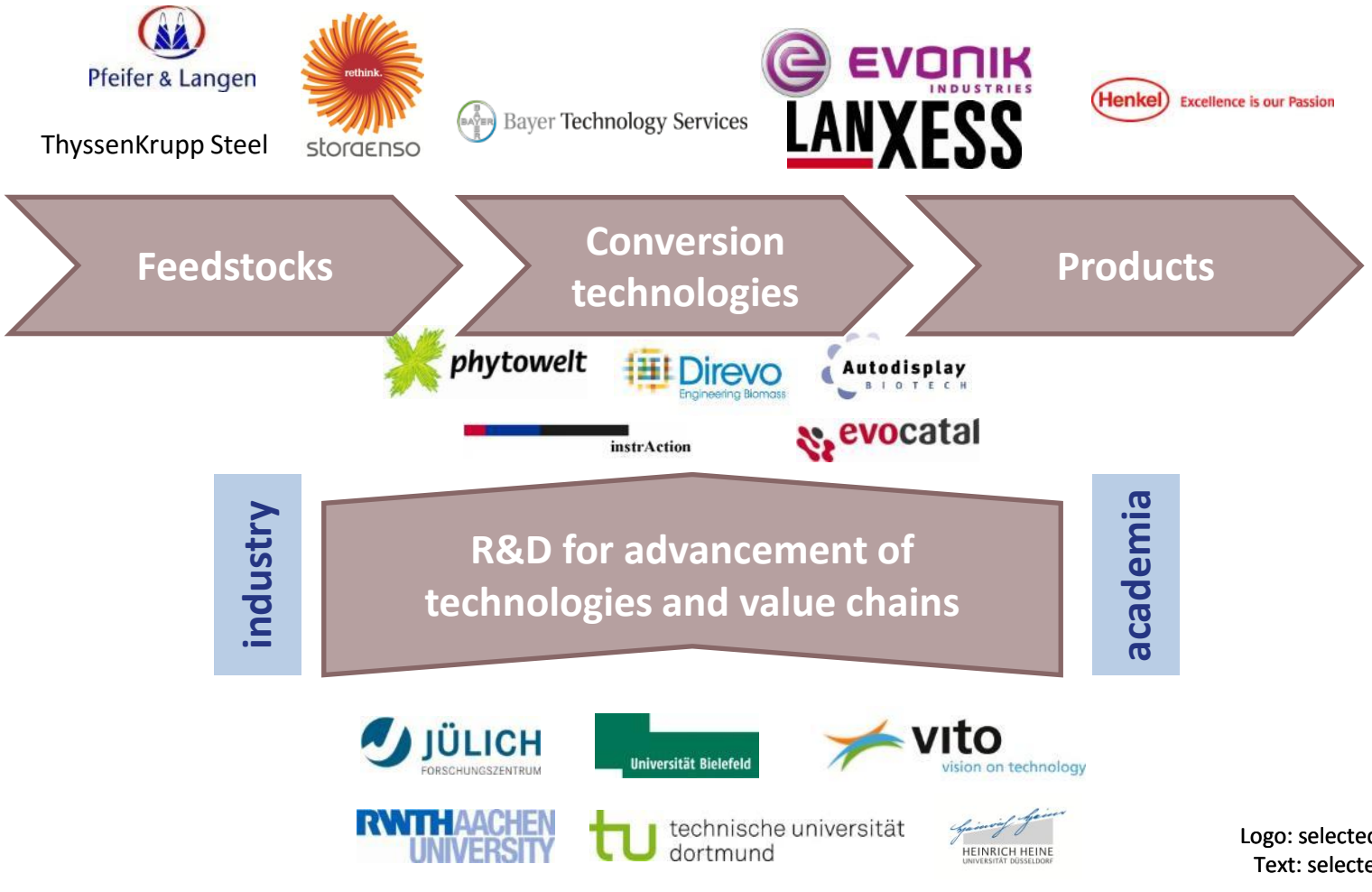


# Novel value chain concepts for the bio- and circular economy




→ Matching of technologies and markets as well as of stakeholders

# CLIB connects partners along value chains

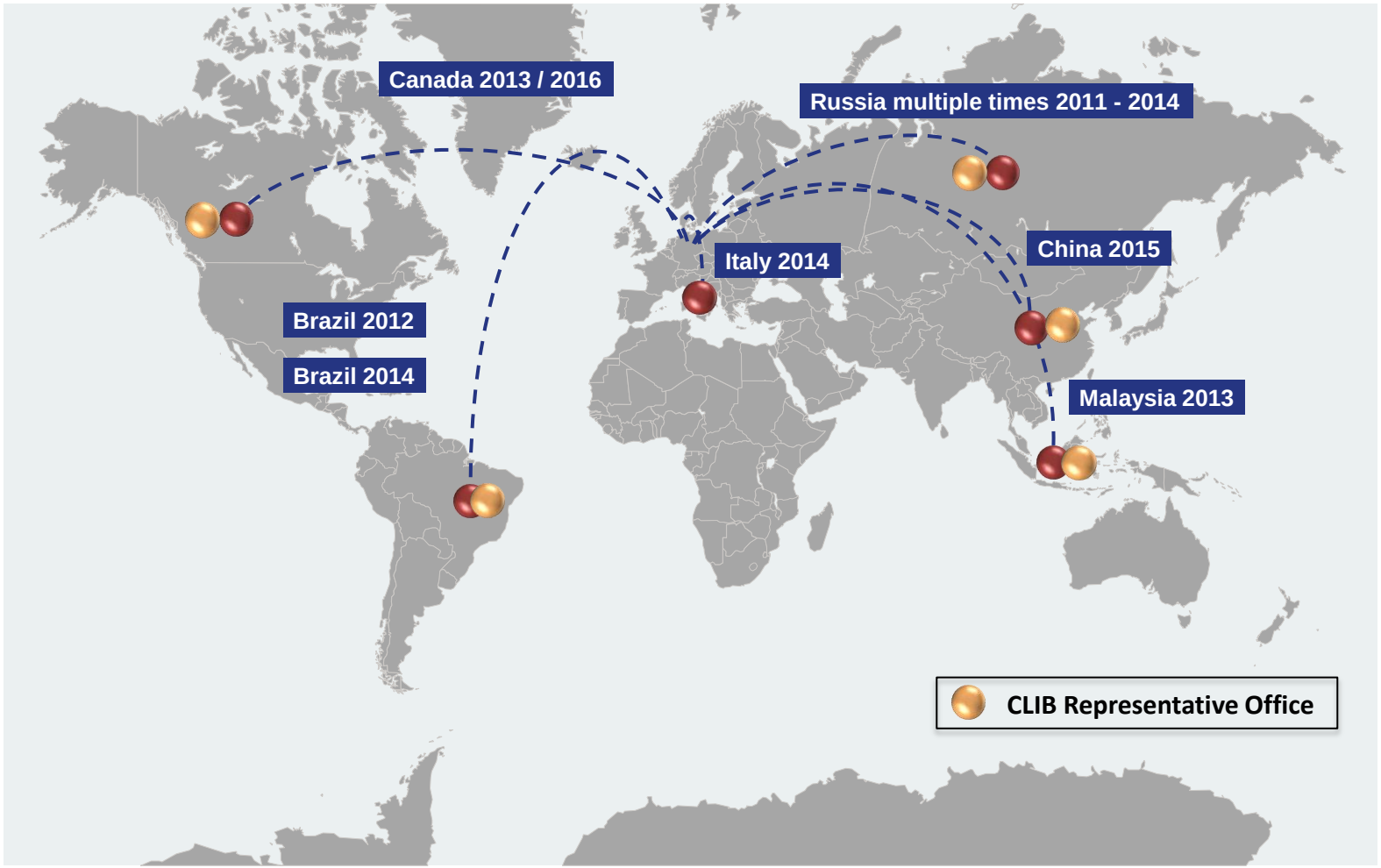



Logo: selected CLIB members
Text: selected CLIB partners

# International Networking

# Well established connections with national and international networks

# Delegation trips & representative offices



# CLIB International Conference

**Networking, scientific exchange and establishing business contacts:**

Since 2010

- 2-day programme
- 150 participants
- International audience


# CLIB Forum Events

**Topics (selection):**

- Shale gas – chances and risks for the bioeconomy
- Alternative feedstocks for the bioeconomy
- Biotechnological solutions for the food industry
- Biocatalysis – What are the market needs?
- Scale-up and scale-down
- Biorefineries
- Alternative jet fuels – impact of biobased feedstocks and industrial biotechnology
- New biobased raw materials for coatings and adhesives
- Biosimilars – potentials & production

# Initiation of R&D Projects

# Key Projects

RIN Stoffströme
Regionales Innovationsnetzwerk

Potential of alternative feedstocks in model region Rhineland (local ministry, 2013-2016)

Interreg North-West Europe
BioBase4SME
European Regional Development Fund

Finished project, new project under evaluation (INTERREG, 2016-2018)

HiPerIn - *High Performance Ingredients*

Biotechnological technology platform for high performance ingredients (NRW, 2016-2017)

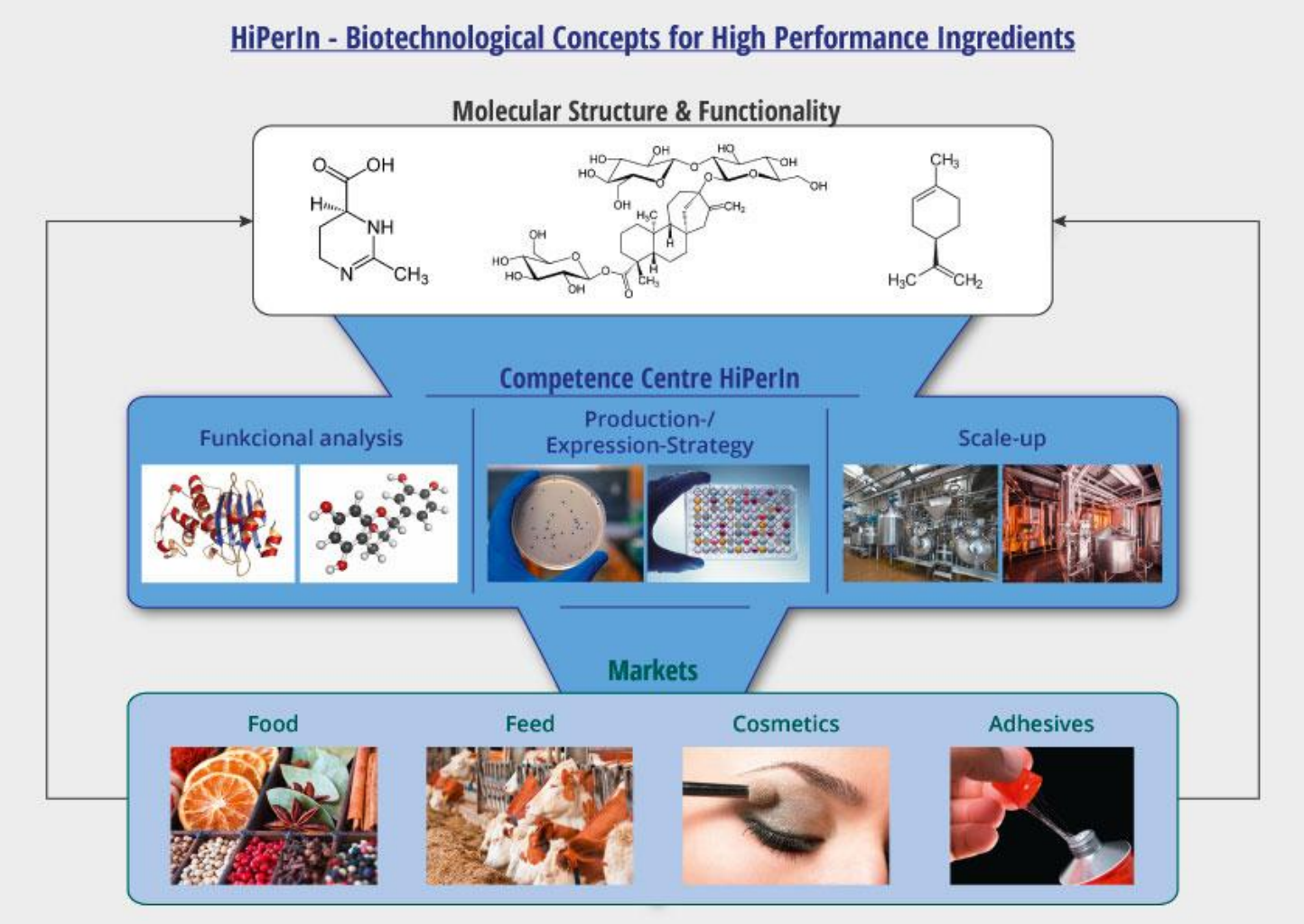
BIG BioInnovation Growth mega-Cluster

Transformation into biobased and circular economy (BMBF, concept phase 2016-2017, project phase 2018-2020)

iNMARE

Marine enzymes as novel biocatalysts (EU, 2015-2018)

# HiPerIn - *High Performance Ingredients*



# RIN Stoffströme

RIN Stoffströme
Regionales Innovationsnetzwerk

- „**Model region for innovative and sustainable material flow**"
- Coordinated by **CLIB**, in cooperation with **EnergieAgentur.NRW** and **Deutsche Gesellschaft für Abfallwirtschaft**

- **Goal:**
  To foster a better utilization of side and waste-streams from industry, agriculture and forestry in the region.
  Prioritizing material usage over energetic utilization (cascading principle).
  Involvement of relevant stakeholders from society, science and industry.

→ Screening of regional biomass potentials
→ Evaluation of different conversion technologies
→ Linkage of practical knowledge with scientific expertese
→ Initiation of novel value chains

**Funded by:**

Ministry of Innovation, Science and Research of the German State of North Rhine-Westphalia

fortschritt nrw

# INMARE – H2020 Project

Industrial Applications of Marine Enzymes

- **Innovative screening and expression platforms to discover and use the functional proteins diversity from the sea.**
- > 20 project partners, universities, SME, large industry
- CLIB members Bayer Technology Services, evocatal, University of Düsseldorf
- WP CLIB: Exploitation: technology evaluation, technology transfer

# BioBase4SME

- Interreg-funded project, under finalisation (signatures on GA)
- Voucher system to support SMEs/start-ups in founding phase in
  - Upscaling at Biobase Europe Pilot Plant
  - LCA
  - Business development
  - Non-technological hurdles: acceptancy, regulations
  - Workshops, trainings

Interreg North-West Europe
BioBase4SME
European Regional Development Fund

# BIG-C: Bio Innovation Growth *mega*-Cluster

- Cross-border *Smart Specialization* Initiative of
  - Flanders
  - The Netherlands
  - North Rhine-Westphalia
- Joint **Bioeconomy Initiative** of these 3 regions
- Task: Transform this region into the world market leader for a biobased and circular economy.
- Core partners are **BE-Basic**, **VITO/FISCH** and **CLIB**, which represent a variety of partners and networks within the regions.

BIG BioInnovation Growth mega-Cluster

# BIG-C flagship value chains

Agriculture

Forestry

Waste

ind.Sidestreams

**F2P Value Chains**

1. Lignocellulose
2. Agro-based biomass
3. Organic side streams
4. $CO/CO_2$-containing gas

**F2P Innovation Programme**

**Horizontal Programme**

***F2P* Flagship**

*Aromatics & Fine Chemicals from Woody Biomass*

Several projects

***F2P* Flagship**

*Chemicals from CO & $CO_2$*

Several projects

***F2P* Flagship**

*Aviation Fuel from Various Feedstocks*

Several projects

***Hor.* Flagship**

*Circular Economy Education*

Several projects

# Education / Young Scientists

# Education / Young Scientists

**National**

CLIB-Graduate Cluster Industrial Biotechnology

Doctoral programme at 3 partnering universities (Bielefeld, Dortmund, Düsseldorf/ FZ Jülich)

**International**

BIG-C Education

Establishment of a joint education initiative between the Netherlands, Flanders and North Rhine-Westphalia

# CLIB – Graduate Cluster

CLIB Graduate Cluster Industrial Biotechnology

- Doctoral programme at 3 partnering universities(2009-2016)
- **> 140 students**, > 75 alumni to date
- **Financial volume: 11.7 M EUR**
- > 300 scientific publications
- Basic research in industrially relevant areas, industrial internship
  - → Training the next generation of biotechnologists and (bio-) chemical engineers
  - → Technology transfer (projects and scientists)


Funded by:

technische universität dortmund

JÜLICH FORSCHUNGSZENTRUM

Universität Bielefeld

HEINRICH HEINE UNIVERSITÄT DÜSSELDORF

Ministry of Innovation, Science and Research of the German State of North Rhine-Westphalia

# CLIB Office

**Uwe Wäckers**
- Communication
- waeckers@clib2021.de

**Dr. Thomas Schwarz**
- Cluster Manager
- schwarz@clib2021.de

**Dr. Cornelia Bähr**
- BIG-C
- $C_1$ processes
- baehr@clib2021.de

**Dr. Tatjana Schwabe**
- BBI, SPIRE, INMARE
- CLIB-Graduate Cluster
- schwabe@clib2021.de

**Sylvia Hannig**
- Office
- info@clib2021.de

**Dr. Carolin Lange**
- BioBase4SME,
- BIG-C Education
- Delegation trips
- lange@clib2021.de

**Sabine Piontek**
- Project Assistant
- RIN Project Assistant
- piontek@clib2021.de

**Dennis Herzberg**
- Head Office Manager
- RIN Stoffströme
- herzberg@clib2021.de

**Dr. Vera Haye**
- BIG-C project management
- haye@clib2021.de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# Thank you for your attention!