

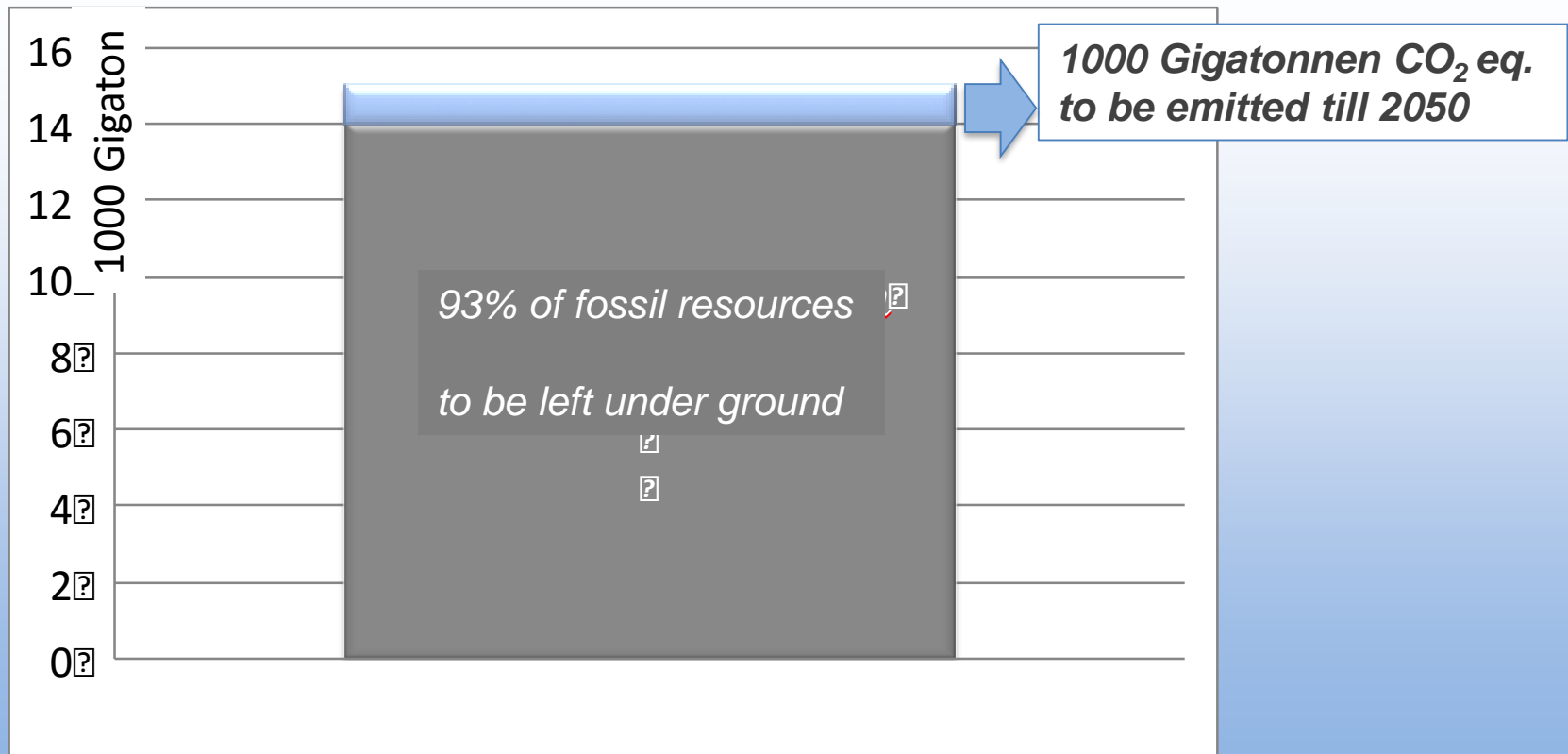
Bioeconomy and the local landscape: new opportunities, new synergies, and new territorial dynamics

Dr. Manfred Kircher
KADIB – Kircher Advice in Bioeconomy

Bioeconomy, a solution of today for the problems of tomorrow?
Arras (France)
20.-21. June 2017

- **Drivers, Challenges and Priorities**
- New Opportunities,
- New Synergies
- New Territorial Dynamics

Paris Climate Agreement drives Feedstock Change



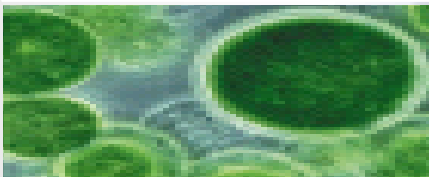
1. Priority: Human Nutrition



Agriculture



Forestry



Aquaculture

➤ *non-food Biomass
for Industrial Purposes*



Food



Materials



Mobility



Energy

2. Priority: Products dependend on Carbon

7 bn t/a Carbon

Global Agro-Photosynthesis
(123 bn/t*a total on land)

Foto: 4026mdk09



Foto: 4028mdk09

To compare:
11 bn t/a fossil carbon
globally used

Foto: Bernd Schwaiblmair

93% energy, mobility
7% materials

- Materials
- (Mobility)



Foto: Edward

Food



Foto: Lamilux Rehau

Materials



Foto: KMJ

Mobility



Foto: Bran

Energy

3. Priority: Feedstock-Efficiency



Agriculture



Forestry



Municipal Waste



ind.Sidestreams

- *Cascade use*
- *Carbon recycling*



Food



Materials



Mobility



Energy

- Drivers, Challenges and Priorities
- **New Opportunities**
- New Synergies
- New Territorial Dynamics

Biomass-Heat and -Power established



[The campaign](#)

[Why Biomass Counts? »](#)

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In the EU, renewable energy in heating could allow saving **€ 21 billion** annually from 2020 onwards compared to 2012 through reducing fossil fuel imports. (AEBIOM; EGECE; ESTIF; World Bank)

In 2013, pellets used in individual heating appliances in Europe allowed savings of close to **€1.9 billion** for households when compared with what would have been the case had heating oil been used instead. (EU Market Observatory for Energy; European Pellet Council)

To date, more than **95%** of woody biomass consumed in Europe for heat and electricity is EU locally produced and contributes to the **diversification and security** of energy supply. (AEBIOM)

1st gen. Biogas (heat, power, methane) established

Biogas from Energy Crop Digestion



Photo 7: Silage dosing unit (back) with spiral elevator (front).
The silage clamps can be seen in the back.



Photo 8: Solid substrate grinder (right) as used for preparation
of the dry substrates (maize) in anaerobic digestion of energy crops



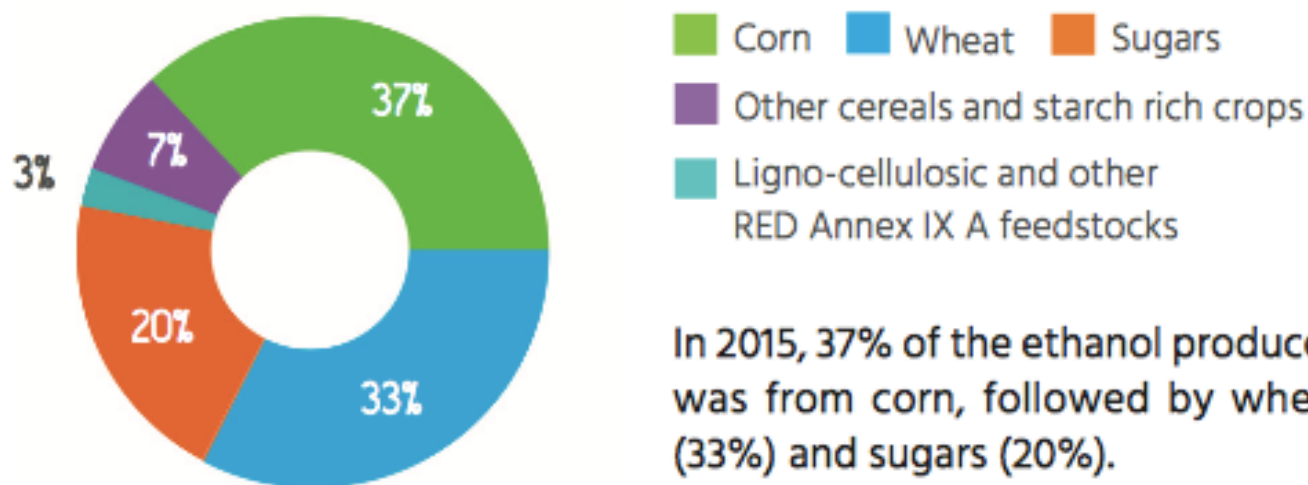
Photo 9: General view of a 2-step energy crop digestion plant with
digester 1 (right) and combined gas collector and digester 2 (left)



Photo 10: General view of a 2-step energy crop digestion plant with digester 1
and digester 2 combined with membrane gas collector (background). The
covered final digestate storage tank can be seen in the right foreground.

1st gen. Biofuel established

Share of European renewable ethanol produced from each feedstock type



In 2015, 37% of the ethanol produced was from corn, followed by wheat (33%) and sugars (20%).

Source: Aggregated and audited data of ePURE members

1st gen. Biochemicals penetrate Markets

19.4.2016



Paints Launched By Mäder Based On Reverdia's Biosuccinium™

Mäder, the leading producer of paints and coatings, will launch its new range of bio-based alkyd paints using Biosuccinium™ from Reverdia, in collaboration with Roquette. The new innovative paint range is based on a combination of Reverdia's Biosuccinium™ and Roquette's POLYSORB® isosorbide, allowing for key physical properties, such as hardness and scratch resistance. Both Biosuccinium™ and POLYSORB® are commercially available bio-based materials.

Commercialised under the brand CAMI, the CADÉLI range includes two EU Ecolabel-certified products. Both are 98% bio-based and have additional functionalities:

CADÉLI Anti-Microbial interior paint

CADÉLI Depolluting (anti-formaldehyde) interior paint



More 1st gen. Biochemicals demonstrated

Evry; 10.5.2016



GLOBAL BIOENERGIES: Scale up of the Isobutene process has been demonstrated

Evry (France), 10 May, 2016 – Global Bioenergies (Alternext Paris: ALGBE) announces that the performance obtained in 2015 at laboratory scale has now been successfully reproduced in the pilot unit installed in Pomacle-Bazancourt (eastern France).

During the last fermentation-trial series, up to 74% of commercial target yield has been achieved. In addition, a high yield (higher than 65% of target) was maintained over several days. Strong robustness of the process is a key parameter for exploitation at larger scale.

Global Bioenergies' Isobutene process is the first-of-a-kind technology to directly produce a gas by fermentation. These results factually demonstrate that the process scales up very well at this stage. The demo plant, presently under construction in Germany, will allow running the technology at ton scale within months.

2nd gen. Biogas established



🔍 Search 🇩🇪 Deutsch

Enter search str



>> Enabling excellence: recycling digestible waste.

We can process your digestible waste – whether from biochemical processes in industrial manufacturing or in food production.

Our industrial biogas plant can sustainably recycle all types of digestible waste: grease trap waste, biogenic wastewater, slaughterhouse blood, mother liquors or solvent mixtures.

With our waste-to-energy approach, your company can also make a valuable contribution to combating climate change: The biogas powers heat and electricity generation.



2nd gen. Biofuel established

**The world's first plant
for the production of second generation
biofuels has been opened in Northern Italy**

9.10.2013



Crescentino in figures

- value of the investment: 150 million Euro
- production: 40,000 tons of bioethanol/year (potential of 60,000 t/a); bioethanol is distributed in Europe, blended with petrol
- area: 150,000 square meters
- biomass used: 270,000 t/y (at maximum potential)
- 13MW electricity production, entirely produced using lignin, the plant is totally self-sufficient with regards to its energy consumption
- water recycling: 100%
- employees: approx. 100

2nd gen. Biochemicals under preparation

Global Bioenergies, Clariant and INEOS receive major EU funding to demonstrate the production of isobutene derivatives from straw



European financing package amounting to €9.8 million, of which €4.4 million for Global Bioenergies

Industry consortium led by Global Bioenergies and bringing together Clariant, INEOS, IPSB, TechnipFMC and Linz University

Aim: converting agricultural residues (wheat straw) into isobutene derivatives for use in numerous applications

Evry (France), 09 May 2017 – Global Bioenergies today announces the signature of a grant agreement aiming at demonstrating a new value chain combining its Isobutene process with technologies developed by Clariant and INEOS, two of Europe's leading chemical companies. The aim is to convert currently poorly valorised residual wheat straw into second generation renewable isobutene for subsequent conversion into oligomers usable in the lubricants, rubbers, solvents, plastics, or fuels. The intense R&D cooperation for the next 48 months starts on June 1st 2017.



2nd gen. Biochemicals under preparation

Corbion seeks allies on alternative feedstock for PLA project

Wanted: enthusiastic consortium members to create value chain

by: Karen Laird in Materials, Sustainability on September 30, 2016



Last week, lactic acid producer Corbion (Amsterdam, the Netherlands) organized an extremely well attended and highly worthwhile get-together in Amsterdam at a venue overlooking the city's IJ river. The goal was an ambitious one: to join forces on second-generation feedstock for PLA. As had been previously announced, the company had already successfully produced PLA based on second generation feedstock at lab scale. Commercializing the technology, however, will require significant investment and partnering throughout the value chain. Corbion is

therefore seeking to form a consortium of enthusiastic partners to share the burden.

3rd gen. Biofuel from CO under development



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Low Carbon Fuel Project Achieves Breakthrough



[LanzaTech > News > Media Releases > Low Carbon Fuel Project Achieves Breakthrough](#)

[← LanzaTech selected to participate in Unreasonable Impact US](#)

[LanzaTech Makes CNBC Fourth Annual Disruptor's List →](#)

Posted on September 14, 2016 in [Media Releases](#)

[0 Comments](#)

Low Carbon Fuel Project Achieves Breakthrough as LanzaTech Produces Jet Fuel from Waste Gases

for Virgin Atlantic

- For the first time ever, 1,500 US gallons of jet fuel has been produced from 'Lanzanol' – LanzaTech's low carbon ethanol
- Producing the world's first jet fuel derived from waste industrial gases from steel mills, via fermentation process
- The alcohol-to-jet (AtJ) fuel has passed all its initial performance tests with flying colours
- Initial analyses suggest the new fuel will result in carbon savings of 65% compared to conventional jet fuel

3rd gen. Chemicals from CO under development

Global Bioenergies finalizes acquisition of Syngip

Access to third-generation resources

Process expected to be profitable starting at \$45 per barrel – Further improved environmental benefit

Dilution of 1.1% for existing shareholders, possibly reaching 3.1%



Evry (France), 2 February 2017 – Global Bioenergies (Alternext Paris: ALGBE) has finalized the acquisition of Syngip B.V. at the close of its extraordinary shareholders' meeting today. Syngip B.V. is a start-up based in the Netherlands that specializes in converting third-generation resources into fuels and materials.

The Syngip acquisition is central to Global Bioenergies' strategy of diversifying the feedstocks suitable for use in its isobutene process:

- Since inception in 2008, Global Bioenergies has been developing a process to convert first-generation sugars (sugar beet and sugar cane molasses, cereals, etc.) into isobutene. This molecule is associated to a vast market in fuels and in materials (plastics, rubber and cosmetics...). The process has matured to the demo plant stage (100t annual nominal capacity).
- Second-generation resources (sugars from straw or wood chips) were also selected for the process as they cost less and have an even smaller environmental footprint. The conversion of these second-generation resources has been successful in the lab, before progressing to pilot scale.
- Access to third-generation resources has been part of Global Bioenergies' strategy since 2011 and completes the Company's strategy of feedstock diversification. It will enable a dramatic reduction of the production cost for renewable isobutene and will improve the environmental footprint of the process even further.

3rd gen. Chemicals from CO₂ under development

Green shoots but slow growth

17 Feb 2017

Topics: [biopastics](#)

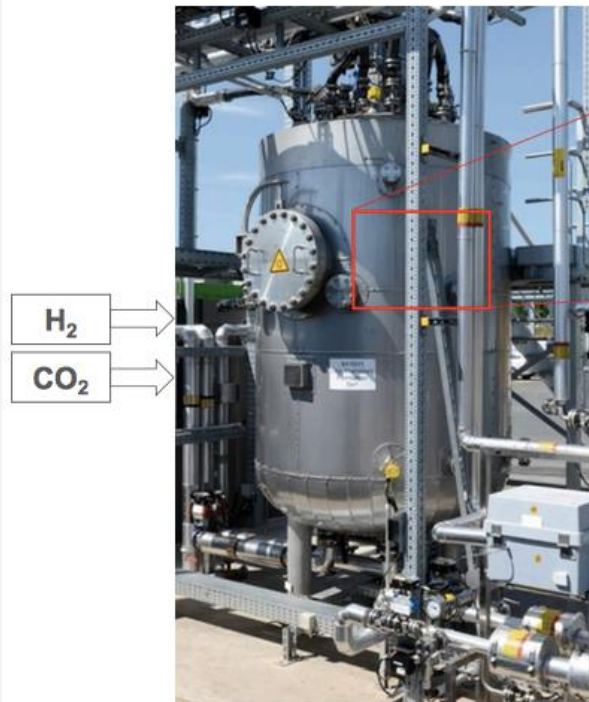


Meanwhile, the Dutch-based next generation clean chemical production platform developer Photanol has confirmed it can produce lactic acid and additional biomass media by allowing the cyanobacteria to grow in conjunction with sunlight and CO₂ via a basic photosynthesis process - and that it claims can be between 10 - 15 % more cost-effective than PLA derived through the traditional sugar cane route. Demonstrating PLA's versatility, Corbion has used it as a replacement for PP cones traditionally used to protect rubber trees during their formative growing phase. Whereas the rubber industry in Thailand has traditionally experienced irreparable damage to the root system of a significant proportion of young trees when the protective cone is removed, the PLA alternative simply composts post-use.

3rd gen. Biogas (heat, power, methane) from CO₂ under development

Biological Methanization of CO₂

VIESSMANN



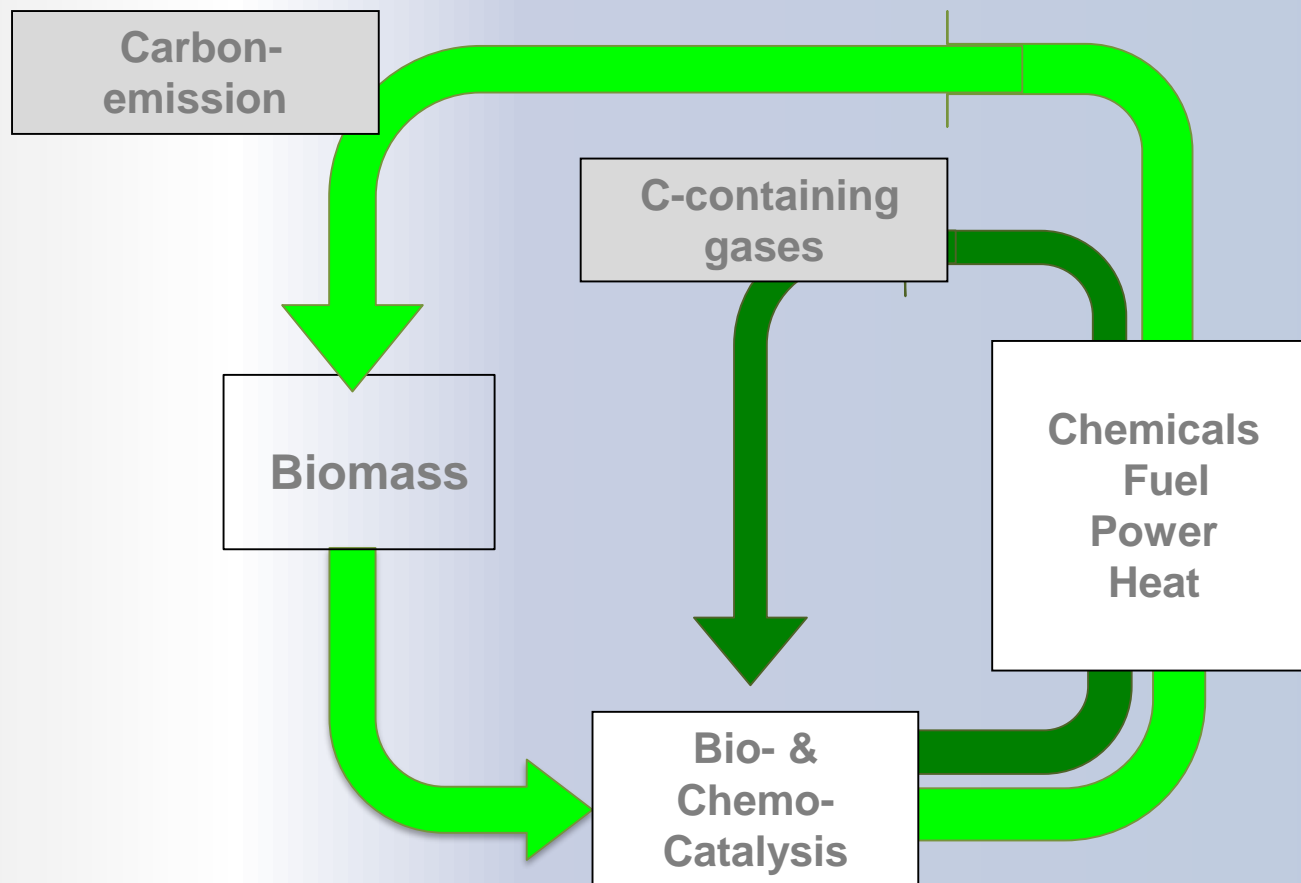
Microorganisms (Archeae) in aqueous suspension (40-70°C)



- CH₄-level > 98%
- High robustness
- Fast and flexible load change
- Low temperature and pressure
- Down- and upscaling

1st, 2nd, 3rd gen. Processes

close Natural & Industrial Carbon Cycle



- Drivers, Challenges and Priorities
- New Opportunities
- **New Synergies**
- New Territorial Dynamics

Companies match along the Supply Chain

Home → News and media → News → 2015 → July

ArcelorMittal, LanzaTech and Primetals Technologies announce partnership to construct breakthrough €87m biofuel production facility



ArcelorMittal, the world's leading steel and mining company, LanzaTech, the carbon recycling company, and Primetals Technologies, a leading technology and service provider to the iron and steel industry today announce they have entered into a letter of intent to construct Europe's first-ever commercial scale production facility to create bioethanol from waste gases produced during the steelmaking process. The resulting bioethanol can cut greenhouse gas emissions by over 80 per cent compared with conventional fossil fuels. It will predominantly be used in gasoline blending, but it can also be further processed into other products such as drop in jet fuel.

The 47,000 ton ethanol/annum project, sufficient to fuel half a million cars with ethanol blended gasoline, will demonstrate the added value of recycling waste streams, not only by reducing emissions at source, hence reducing ArcelorMittal's direct carbon footprint, but by keeping fossil fuels in the ground through the production of commodity chemicals and fuels that would otherwise be made from oil.



ArcelorMittal



Companies match bio-based Business Models

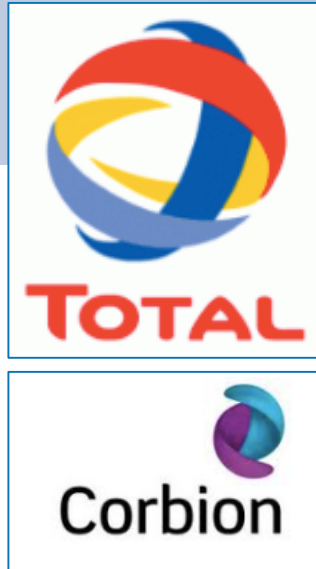
11/16/2016 - *PRESS RELEASE*

TOTAL AND CORBION FORM A JOINT VENTURE IN BIOPLASTICS

Extract from the press release.

Paris, Amsterdam - Total and Corbion are joining forces to develop bioplastics by creating a 50/50 joint venture to produce and market polylactic (PLA) polymers. The two partners plan to build a world-class PLA polymerization plant with a capacity of 75,000 tons per year at Corbion's site in Thailand that already has a lactide (PLA monomer) production unit that will become part of the joint venture. Corbion will supply the lactic acid necessary for the production of the PLA and the lactide.

The new company will be based in the Netherlands and will launch operations in the 1st quarter of 2017, subject to regulatory approvals.



Companies match Innovation and Capacity

Synvina: Joint venture of BASF and Avantium established

7 Oct 2016 | 2016, Press releases



- Bio based Furandicarboxylic acid (FDCA) as main building block for polyethylenefuranoate (PEF)
- FDCA production plant with of up to 50,000 tons capacity planned
- PEF with multiple application opportunities like packaging, engineering plastics, coatings, and fibers
- Starting point to build up world-leading positions in FDCA and PEF

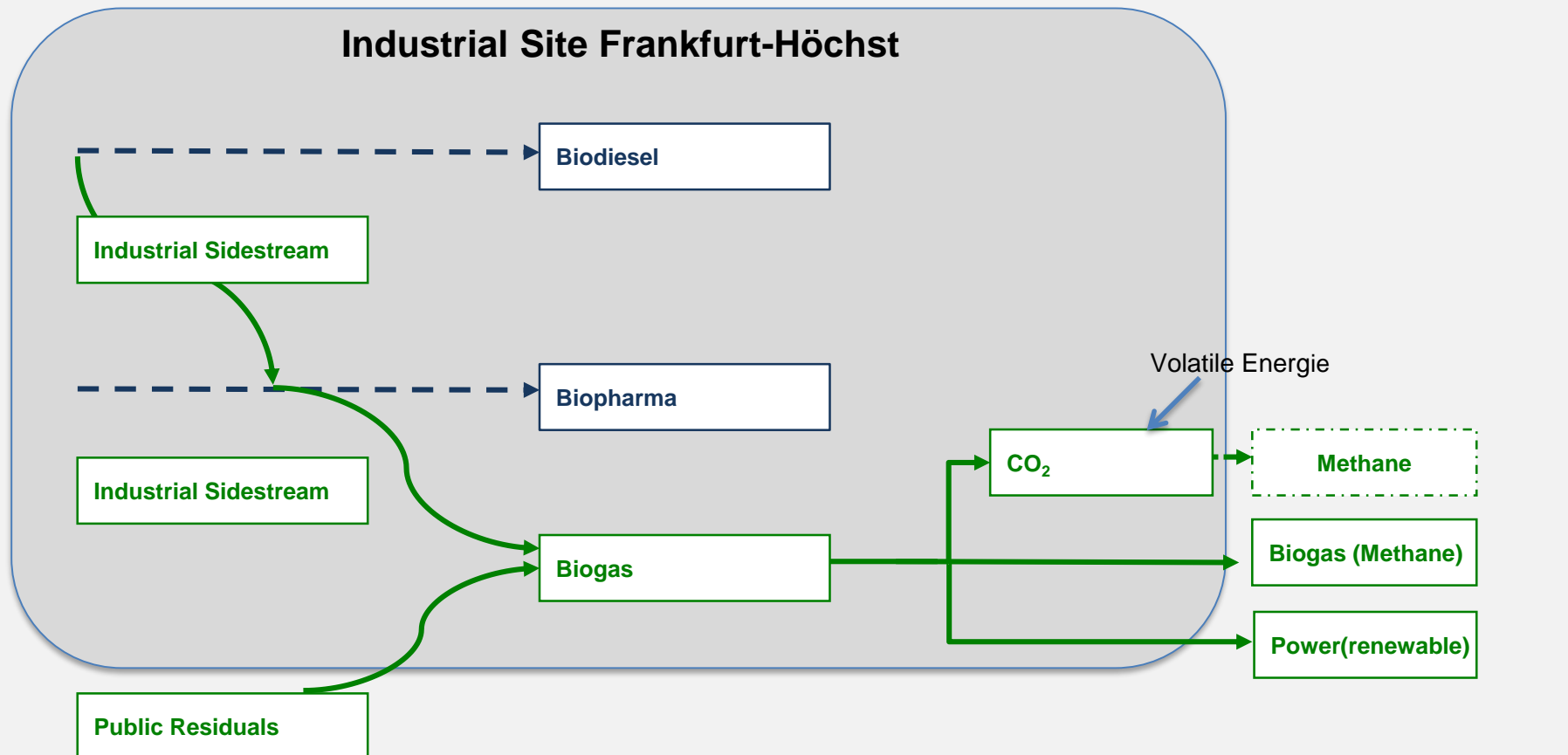
Ludwigshafen, Germany, and Amsterdam, Netherlands – October 07, 2016 – BASF and Avantium, the renewable chemistry company, today announced the formation of a new joint venture (JV) for the production and marketing of furandicarboxylic acid (FDCA), which is produced from renewable resources, as well as the marketing of polyethylenefuranoate (PEF) based on the new chemical building block FDCA.

BASF
We create chemistry



Companies match along Cascading

Region Frankfurt-Höchst



- Drivers, Challenges and Priorities
- New Opportunities
- New Synergies
- **New Territorial Dynamics**

Biorefinery of Bazancourt-Pomacle based on wide-spread Wheat and Sugar Beet

This Biorefinery is one of Most Integrated Existing Biorefineries

Chamtor
Wheat processing

BioD mo (ARD)
Industrial demonstration plant

Cristal Union
Sugar beet refinery



Proc thol 2G
FUTUROL Project
2nd generation ethanol

ARD
Mutualised research center

Soliance
Actives and ingredients for cosmetics

Cristanol
1st generation ethanol production



Novamont utilizes Regional Biomass

31 October 2013

Thistle-based plastic from Novamont

Charlotte Eyre



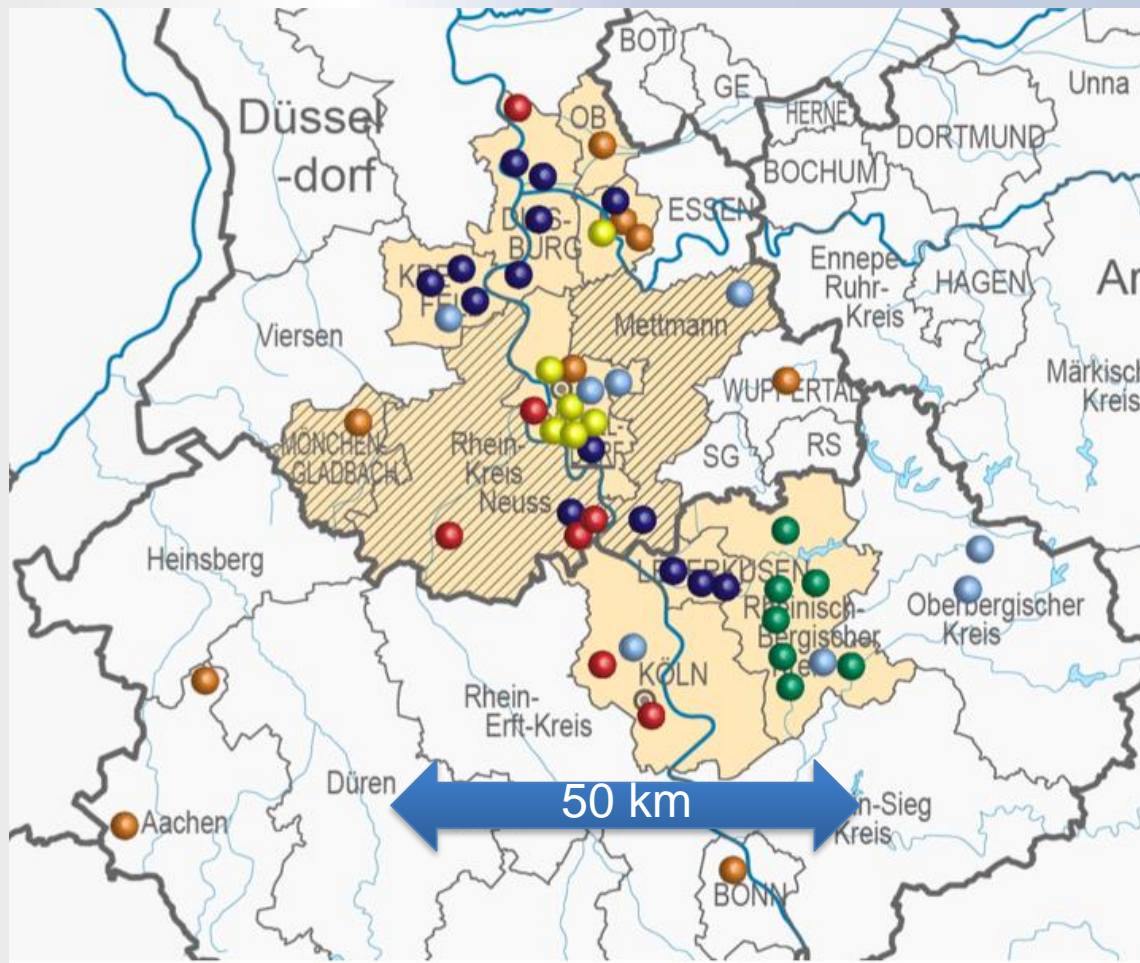
Italy-based Novamont is using vegetable oil derived from the thistle plant to make the latest generation of MaterBi, its range of compostable and biodegradable resins.

At K 2013, sales manager Alberto Castellanza said the company started to investigate thistles as a feedstock after investing, along with petrochemicals producer Versalis, in a bio refinery in Sardinia, Italy.

“Thistles need very little water or fertiliser, so it is the perfect crop for Sardinian weather, which is hot and dry and has very little rain,” he told European Plastics News.

Another advantage is that there is no competition with feedstocks, he added.

Rural, Industrialized and Metropole Regions provide 1st, 2nd, 3rd ... gen. Carbon Streams



- Industry (chemistry, steel)
- Waste management facilities
- Academia
- Forest industry
- Power plants
- Networks, associations
- ▨ > 40% agricultural area

*RIN is supported by MIWF

Merci beaucoup!