ATB

Leibniz-Institut für
Agrartechnik und Bioökonomie

Some aspects of BIOECONOMY in…
Germany, Leibniz Association, ATB…

bioeconomy

1st INTERNATIONAL SYMPOSIUM ON BIOECONOMY

SAO PAULO – BRAZIL

9th and 10th December 2016

Leibniz-Gemeinschaft

History

- 1927 Experimental farm of the Agricultural University Berlin
- 1933 Independent research center on agricultural mechanization
- 1952 Central institute of agricultural engineering of East Germany
- 1992 Reestablished after the reunification of Germany

Today:

Leibniz Institute for Agricultural Engineering and Bioeconomy

- member of the Leibniz Association

Leibniz-Gemeinschaft

Comprehensive definition of bioeconomy

Plants, Microbes, Animals, Biodiversity,
Biotechnology, „C“ in CO_2, biological knowledge

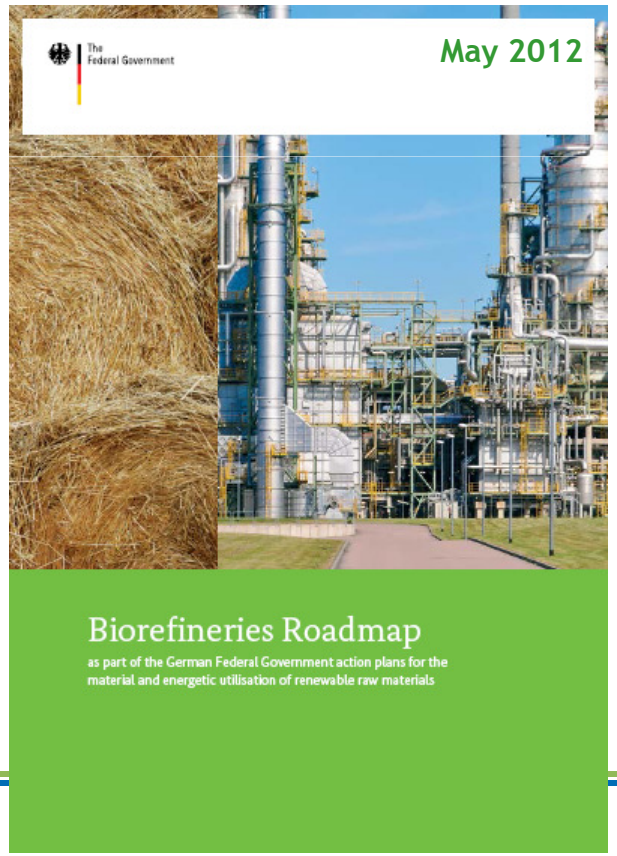
Sustainable production and use of biological resources, processes and principles to provide products and services in all economic sectors.

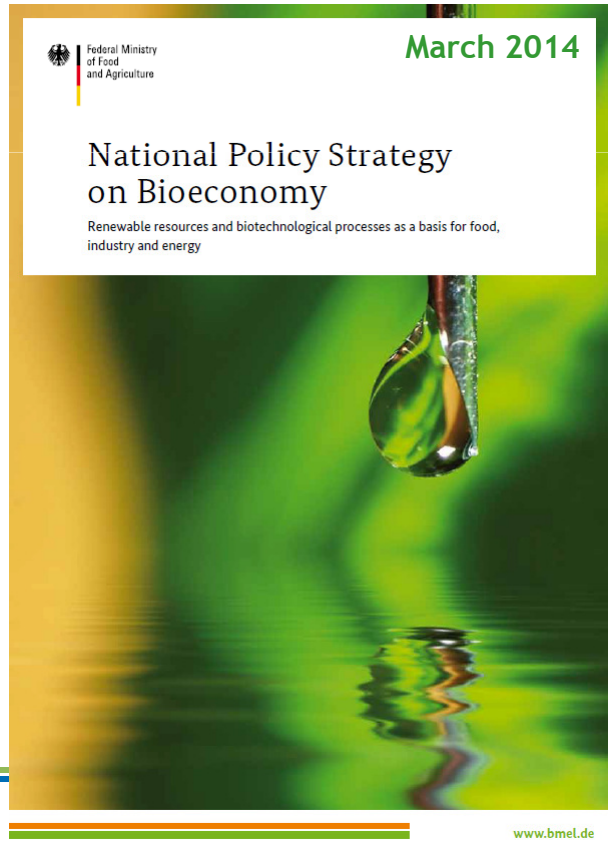
Agriculture/Forestry/Fisheries, Food, Paper, Textiles, Building & Construction, Paper, Chemistry, ICT, Pharma…

Industrial Biotechnology - Using renewable resources for industry

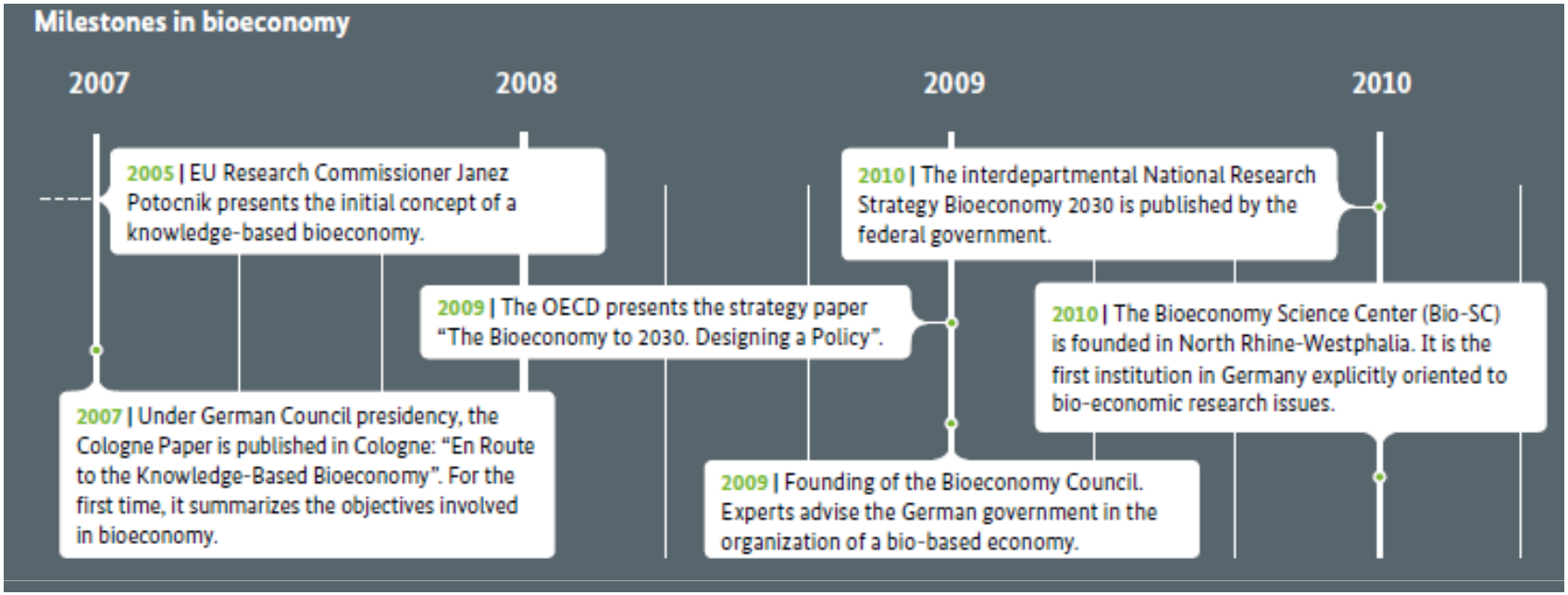
Biobased products and processes from renewable resources not only help preserve the environment and climate,

but also make a significant contribution to the structural change from a petrochemical to a **biobased industry**, with related opportunities for growth and employment. **Industrial biotechnology, also known as white biotechnology**, is an important driving force in this transition.





Bioeconomy Policy in Germany



2014 Coalition Agreement

- Promotion of Bioeconomy
- Concepts for cultivation, processing and utilization of biomass

2015 Framework research program on sustainable development (FONA^3)

- Bioeconomy as a pillar of green economy
- Research on new industrial value-chains based on biomass

2016 Sustainable Development Strategy for Germany

- BE contributes to SDGs on Growth, Industrial Innovation, Sust. Production & Consumption, Life on Land (8, 9,12 & 15)

2016 5th Innovation dialog of the 18th legislative period

- "Innovation potentials of biotechnology" with Angela Merkel

Bioeconomy Council – 17 members

- Mix of practitioners and researchers

- Broad field of thematic expertise:
  - from farming to nutrition
  - from agro-science to industrial biotechnology
  - from biodiversity and sustainability to food security
  - from economics to consumer marketing
  - from policy design to evaluation

Bioeconomy Council – Objectives & Tasks

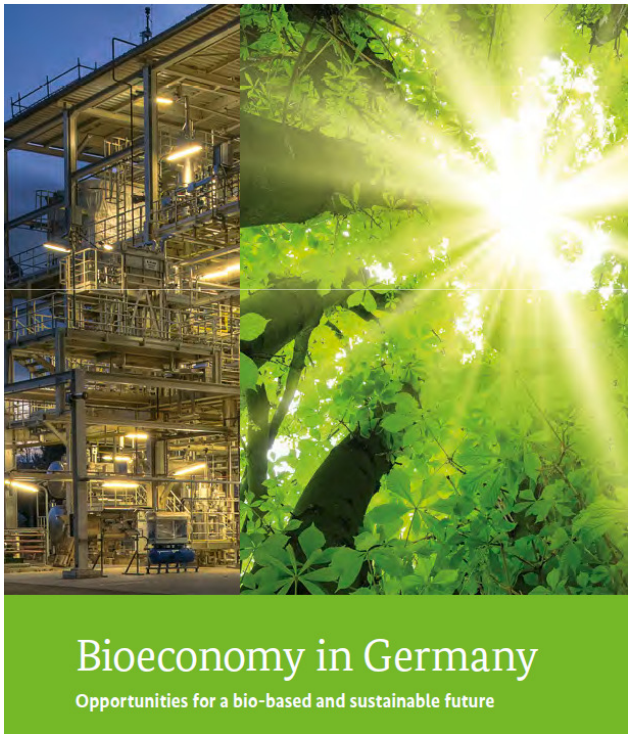
Goal

Implementation of an innovation-driven **biobased economy** in Germany that combines **economic growth** with **ecological sustainability.**

Federal Ministry of Education and Research
Federal Ministry of Food and Agriculture

Main Tasks

1. Advising on the German R&I policy for bioeconomy
2. Advising on the implementation of political strategies
3. Dialogue with societal stakeholders

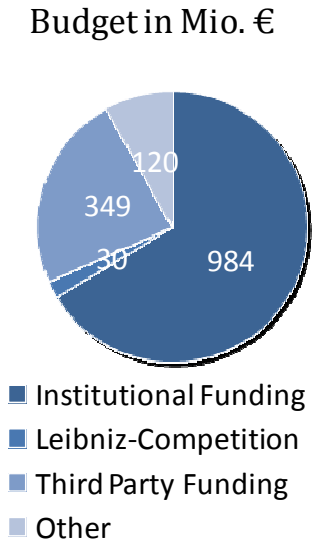


Publications & Recommendations of the Council

www.biooekonomierat.de

Leibniz at a glance I

- Founded in 1995
- 88 institutes:
  - 63 research institutes
  - 17 research infrastructure facilities
  - 8 research museums
- 18,000 employees; 9,300 researchers
- Total budget of > € 1.7 billion
- Institutes are financially and legally independent, decentralised structure
- Joint funding by federal government and federal states (50:50)
- Exemplary system of regular independent evaluation



Leibniz Research Alliances

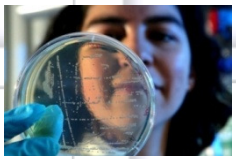
Biodiversity

Energy Transition

Education Research

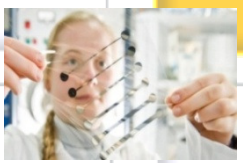
Healthy Ageing

Pharmaceutical Agents and Biotechnology



Historical Authenticity

Science 2.0



Sustainable Food Production and Healthy Nutrition

Crises in a Globalized World

Nanosafety

Medical Technology

Infections ´21

Selected Leibniz institutes with a focus on Bioeconomy

- **Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB)**
- Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle/Saale
- Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg
- Leibniz Institute of Vegetable and Ornamental Crops (IGZ), Großbeeren, Erfurt
- Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin
- Leibniz Institute for Farm Animal Biology (FBN), Dummerstorf
- Leibniz Institute for Plant Biochemistry (IPB), Halle/Saale
- Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben
- Leibniz-Institute DSMZ–German Collection of Microorganisms and Cell Cultures, Braunschweig (Dept. Bioresources for Bioeconomy & Life Sciences)

Leibniz institutes: Bioeconomy main research topics (*selected topics*)

- Aquaculture
- Precision farming and precision livestock production
- Quality and safety of food and feed
- Material and energetic use of biomass
- Technology assessment in agriculture
- Microbial Functional Genomics
- Animal Welfare & sustainable farm animal husbandry
- Plant-Based Bioeconomy
- Agricultural value chains
- Structural Development of Farms and Rural Areas
- Soil Science
- Plant Breeding Research, Molecular Developmental Physiology & Plant Phenotyping

R & D at ATB in the direction of BIOECONOMY

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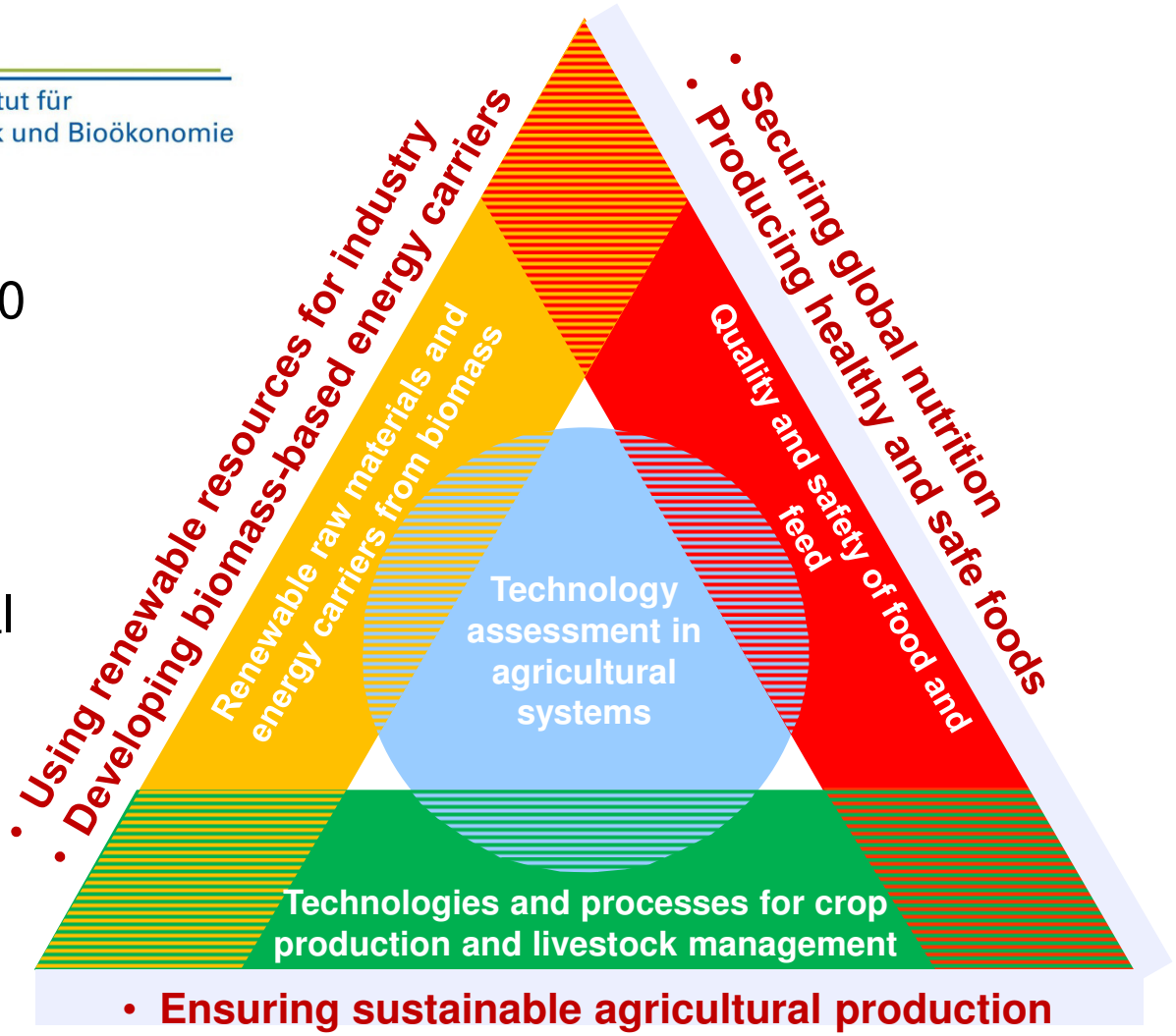
The National Research Strategy Bioeconomy 2030 was published under the direction of the Federal Ministry of Education and Research (BMBF), together with six additional ministries.

➲ the strategy involves **five key fields of action**



Cascading use of biomass / Biorefinery concepts

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Research Program
„Material and energetic use of biomass “

Coordination: Dr. Joachim Venus

Consideration of the entire value chain – System‘s approach

Cultivation, harvest, storage… (short rotation wood, hemp)

Material use (Fibers, biotechnological products)

Energetic use (Biogas, wood pellets, biochar)

Valorization of residues, sidestreams etc.

Scale up: from lab to practice

Pilot plants – Research and technology transfer (funded by ERDF - European Regional Development Fund)

… for the biotechnological production of lactic acid from plant biomass

… for the processing of preserved natural fibres to final products, e.g. construction boards

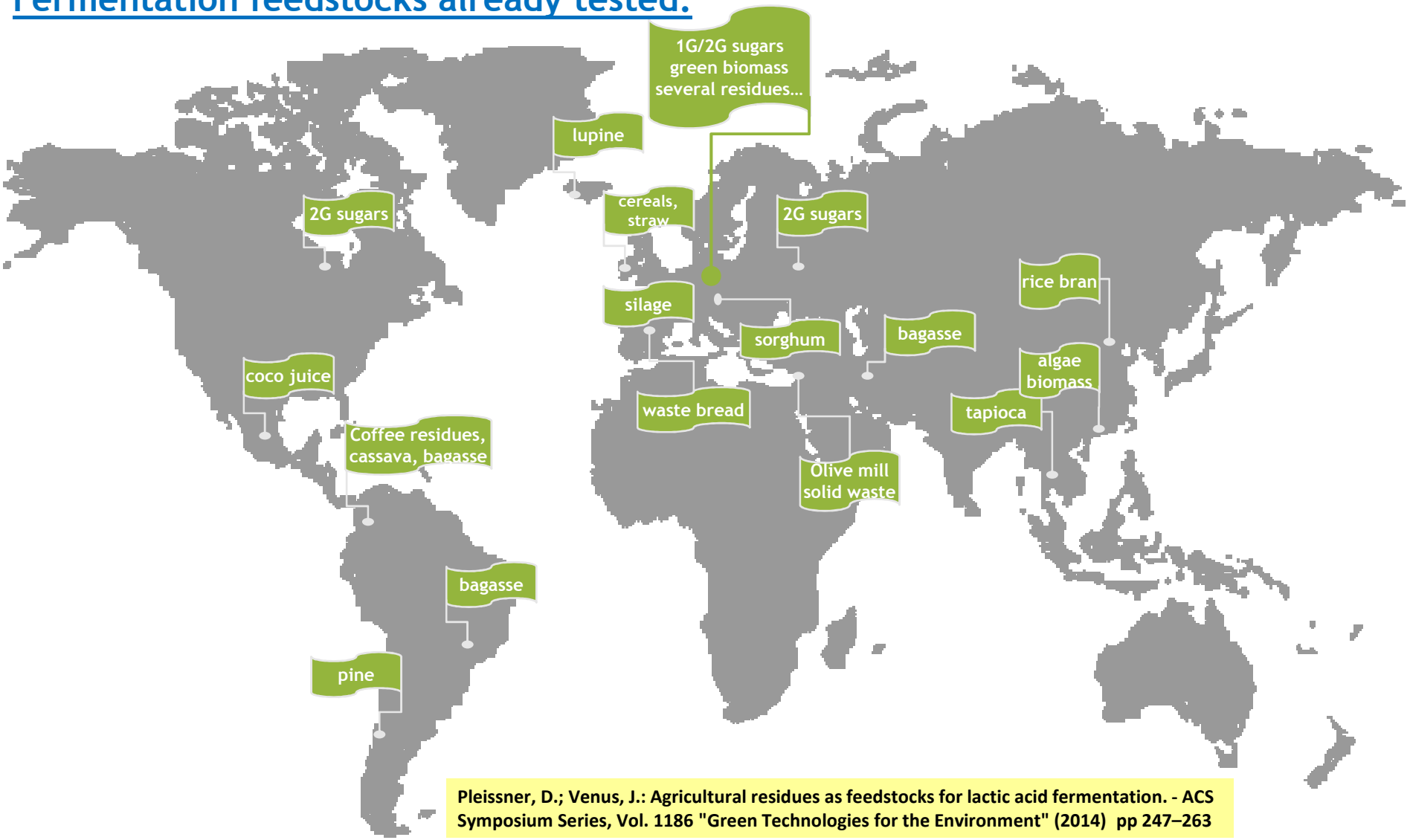
Main Research Fields

For several years, “bioconversion of raw materials produced in agriculture into chemicals, microbial biomass and active substances“ has been the subject of intensive studies in the bioengineering department of the ATB.

- **Industrial Biotechnology, Biorefineries, Scaling-up of Bioprocesses**
- **pre-treatment of biomass for microbial conversion processes, bioconversion of renewable resources**
- **kinetics of cell growth/product formation and modelling of fermentation processes**
- **development of continuous mode processes for the production of basic chemicals (e.g. lactic acid) and biomass**
- **operation of a pilot plant facility for the optimization of biotechnological processes**

Pilot plant facility for lactic acid fermentation at Leibniz-Institute for Agricultural Engineering Potsdam-Bornim / ATB

Fermentation feedstocks already tested:



Pleissner, D.; Venus, J.: Agricultural residues as feedstocks for lactic acid fermentation. - ACS Symposium Series, Vol. 1186 "Green Technologies for the Environment" (2014) pp 247–263

- *Starchy materials (cereals, industrial grade corn/potatoe starch, tapioca)*
- *Green biomass (alfalfa, grass juice, lupine, sweet sorghum, forage rye, silage, coco juice)*
- *Lignocellulosics (wood/straw hydrolysates, 2ndG sugars, bagasse)*
- ***Residues & By-products (oilseed cake/meal, thick juice, molasses, whey, coffee residues, waste bread, waffle residues, algae biomass, fruit residues, rice bran, meat & bone meal, OMSW…)***

Pilot plant facility

- **pilot facility for production of lactic acid** at the ATB consequently fills a gap in the various phases of bioprocess engineering
- **provision of product samples** is intended to open up the possibility of interesting **partners in industry with specific product requirements** in various applications

BIOSTAT® Bplus (Sartorius BBI Systems GmbH, Germany) equipped with a digital control unit DCU for the continuous fermentation with cell recycling

scale up

Pilot fermentor Type P, 450 L (Bioengineering AG)

Venus, J.; Richter, K.: Eng. Life Sci. 2007, 7, No. 4, 395-402
Venus, J.: Feedstocks and (Bio)Technologies for Biorefineries. – In: G.E. Zaikov, F. Pudel, G. Spychalski (Eds.), Renewable Resources and Biotechnology for Material Applications (pp. 299-309), Nova Science Publishers, 2011 (ISBN: 978-1-61209-521-9)

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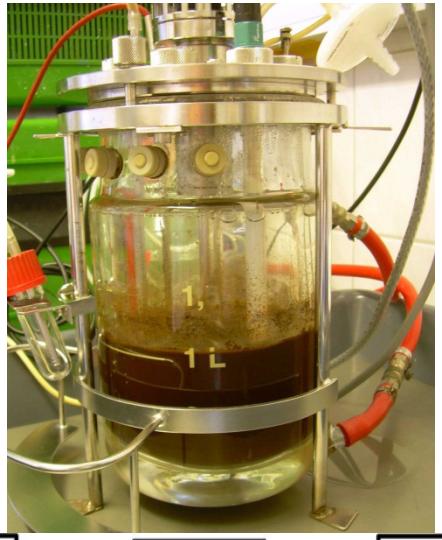
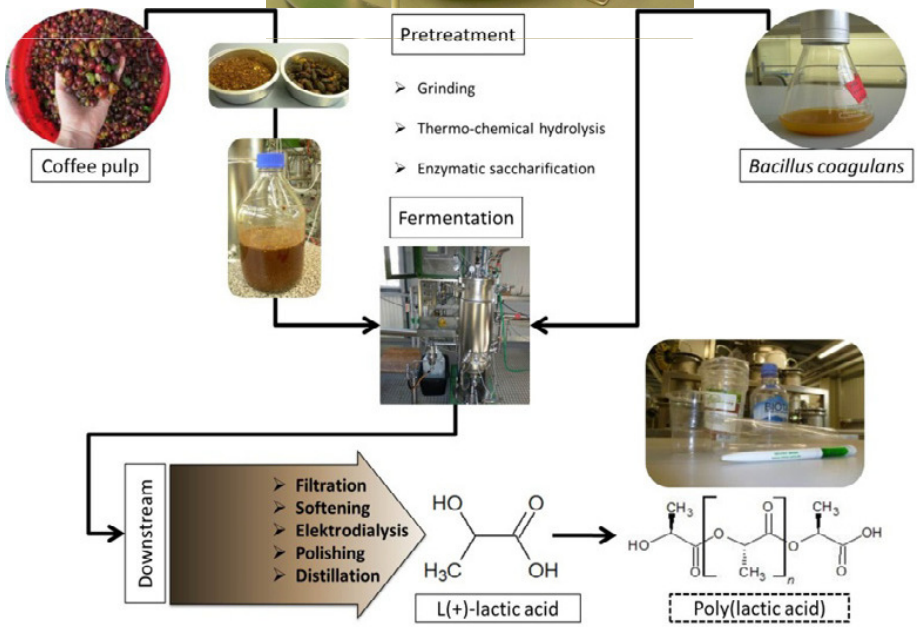
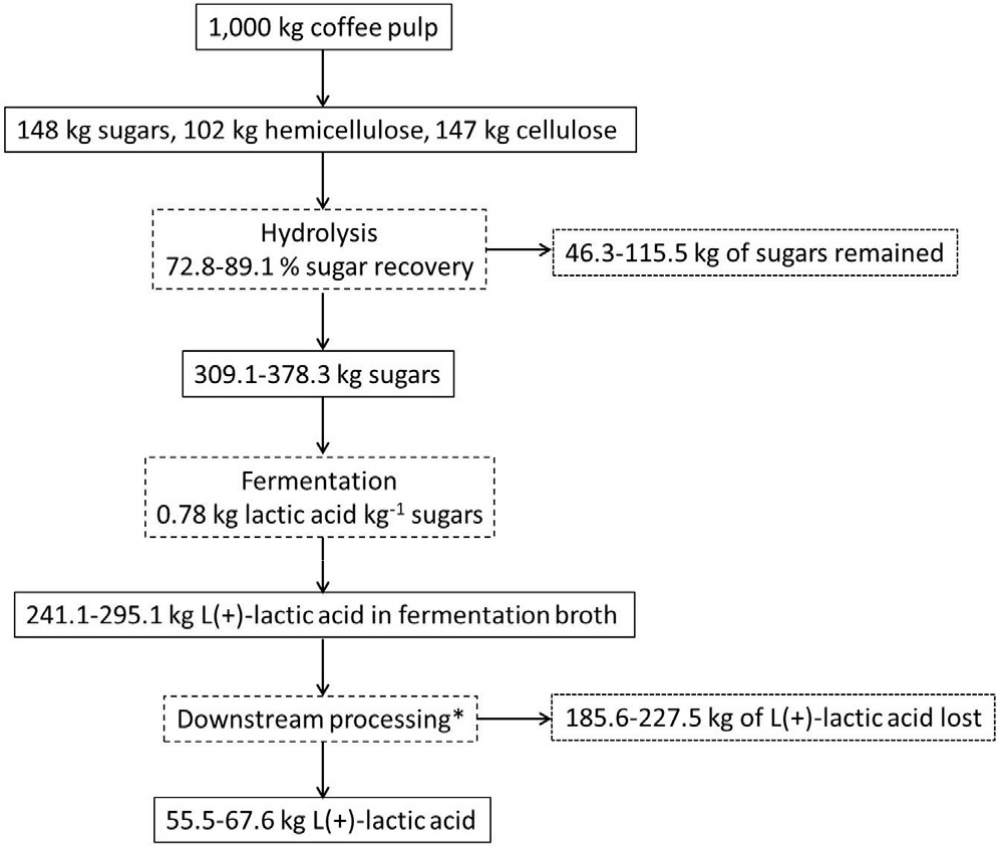
Example coffee residues: residues from the coffee production



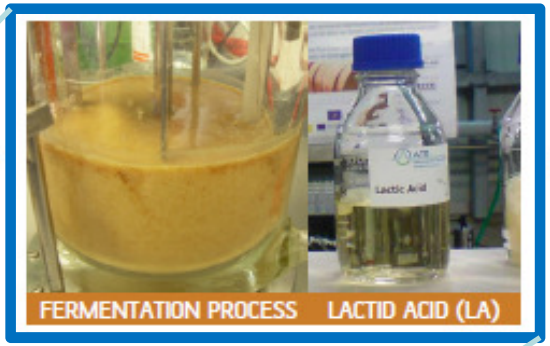


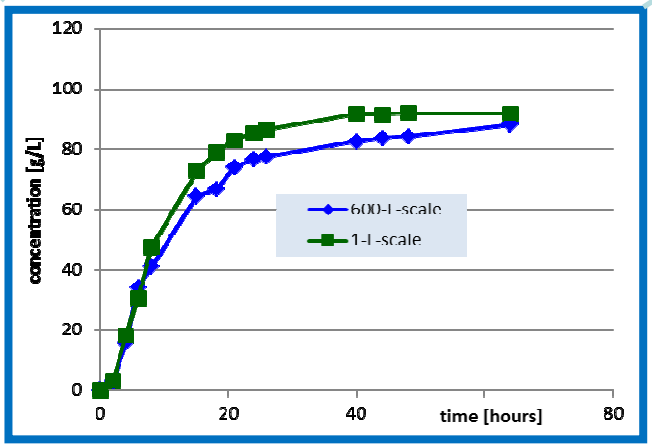


Mass balance from coffee pulp to lactic acid (*downstream processing was not optimized). All figures are based on dry weight.

Pleissner, D.; Neu, A.-K.; Mehlmann, K.; Schneider, R.; Puerta-Quintero, G.I.; Venus, J.: Fermentative lactic acid production from coffee pulp hydrolysate using *Bacillus coagulans* at laboratory and pilot scales. Bioresource Technology 218 (2016) 167–173

Example food waste: Bakery industry





The award ceremony for the best 2015 Life projects took place in the context of "Green Week" (30 May to 3 June) in the Egg Conference Centre in Brussels

ATB & Partner
Leibniz-Institut für Agrartechnik
Potsdam-Bornim e.V.

BREAD4PLA

González, R.; Venus, J.: BREA4PLA Project. V Intern. Seminar "Biopolymers & Sustainable Composites", AIMPLAS (6&7 March, 2014 in Valencia)
Venus, J.: Utilization of Waste Bread for Lactic Acid Fermentation. ASABE and CSBE | SCGAB Annual International Meeting, July 13-16, 2014 – Montréal, Volume 1, 2014, 557-562

Example agro-residues: Sugarcane bagasse

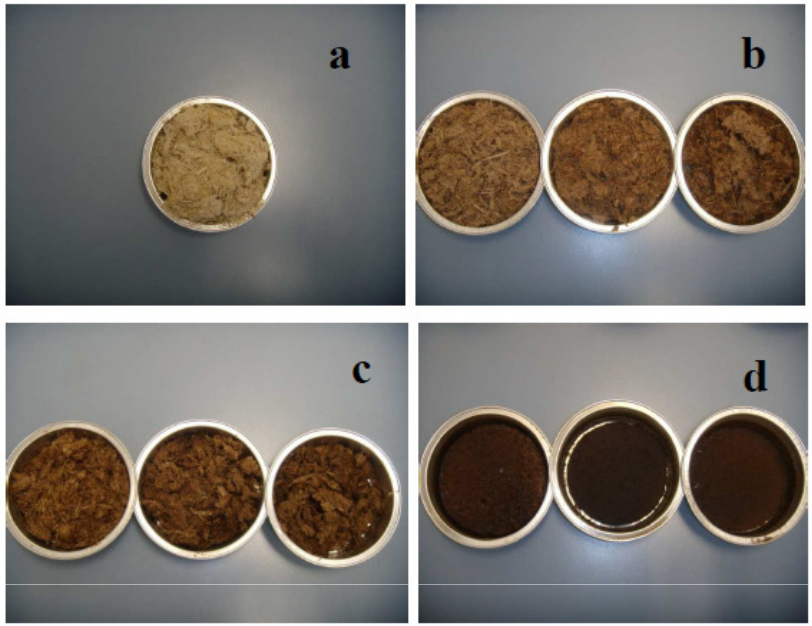


Figura 1 – Fotos de bagaço da cana de açúcar: **(a)** sem tratamento térmico; **(b)** 180°C; **(c)** 200°C e **(d)** 220°C por 5, 10 e 15 minutos (da esq. para dir.).

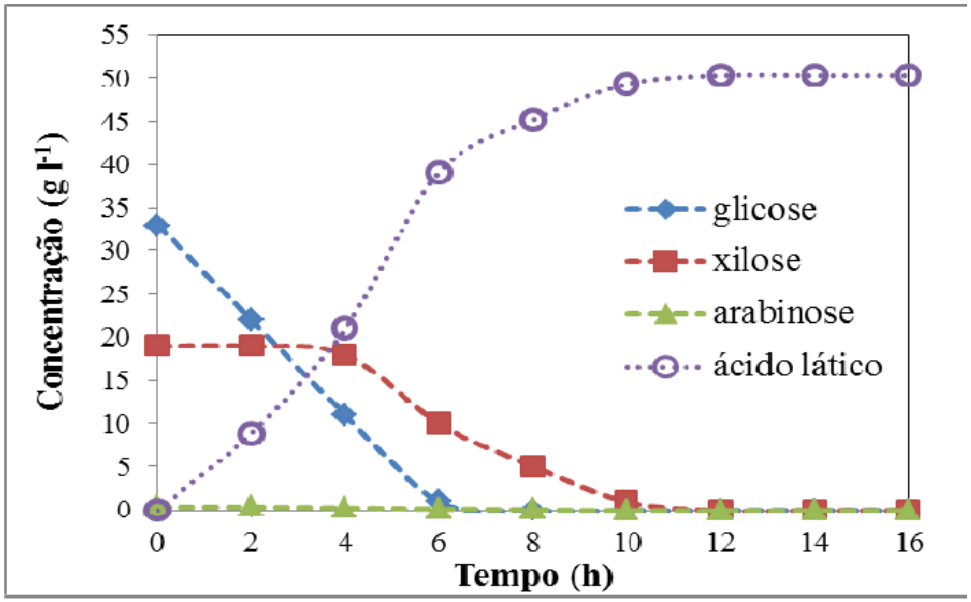


Figura 4 – Produção de ácido lático e consumo de açúcares presentes no meio MRS modificado contendo hidrolisado de bagaço (glicose 33 g l^{-1}, xilose 19 g l^{-1}, arabinose 0,4 g l^{-1}, extrato de levedura 15 g l^{-1}, K_2HPO_4 2 g l^{-1}, $MgSO_4$ 0,1 g l^{-1} e $MnSO_4$ 0,04 g l^{-1}).

XVIII Simpósio Nacional de Bioprocessos
Caxias do Sul/RS - 24 a 27 de julho de 2011
SINAFERM 2011

Hidrólise Térmica de Bagaço da Cana-de-açúcar para Produção Homofermentativa de L-Ácido Lático

Giselle de Arruda Rodrigues[1], Joachim Venus[2] e Telma Teixeira Franco[1]

Pro ast

Biokonversion nachwachsend in Bildung und Forschung mit	s 30.06.08 RA08/A02
Sugarcane biorefinery: bio anc (Zuckerrohr-Bioraffinerie: Bi un	s 31.12.14 N12053 & Forschung mit Brasilien

Gisell
Arruc
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UNIC
Camp
Brazil

14.08
31.07

- Several trips to sdam
- Bilateral project npanies (Braskem, CTBE, Embrapa
- Workshops, con

agropolo
CAMPINAS • BRASIL

Seminário

Biotecnologia Industrial:
conversão de biomassa, biorefinaria e scale-up de bioprocessos

12 de dezembro de 2016 – 10:00 às 11:30 - Campinas - SP
Núcleo Interdisciplinar de Planejamento Energético – NIPE/UNICAMP

O objetivo deste seminário é apresentar a experiência do Dr. Joachim Venus em biotecnologia industrial e fomentar discussões sobre as ações estratégicas e parcerias de pesquisa que poderão ser realizadas em conjunto com as instituições de ciência e tecnologia e o setor produtivo no Brasil.

Dr. Joachim Venus, Cientista Sênior de Biotecnologia Industrial, Coordenador do Programa de Pesquisa "Material and Energetic Use of Biomass" e chefe do grupo de pesquisa de bioconversão/fermentação de matéria prima/resíduos no Instituto de Engenharia Agrícola e Bioeconomia de Leibniz (ATB Potsdam), Alemanha.

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https://www.atb-potsdam.de

Os campos de pesquisa de interesse, incluem:

- *biotecnologia industrial, biorefinarias e scale-up de bioprocessos;*
- *pré-tratamento de biomassa para processos de conversão microbiana e bioconversão de fontes renováveis;*
- *cinética de crescimento celular / formação de produto e modelagem de processos de fermentação;*
- *desenvolvimento de processos em fluxo contínuo para a produção de produtos químicos básicos (p. exemplo, ácido láctico);*
- *operações de plantas piloto para a otimização de processos biotecnológicos.*

Informações & Inscrições:
Guilherme Brandini – (19) 3521-1718
brandini@nipe.unicamp.br

Vagas limitadas
Evento gratuito e em inglês
(não haverá tradução simultânea)
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Organização/Apoio

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Thank you very much…

…and let's go ahaed!

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