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# International Bioeconomy: Opportunities for collaboration between Germany and Brazil

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Presentation on sustainable food production on the 1<sup>st</sup> International symposium on Bioeconomy 2016

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Fraunhofer Institute for Process Engineering and Packaging

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# Bioökonomie 2030 – The German National Research Strategy

# Societal challenges in the 21<sup>st</sup> century



- Increasing world population and changes in food utilisation patterns
- Increase of food associated diseases
- Climate change/protection, resource conservation/protection
- Need for a sustainable energy production
- Transfer from a fossil to a bio-based raw material supply

# Knowledge-based Bioeconomy – Vision and Objectives



Germany pursues the vision of a  
natural, cycle-oriented,  
sustainable  
biobased economy  
that carries the promise of  
global food supplies that are both  
ample and healthy,  
and of high quality products from  
renewable resources.

With our research, we want to meet our responsibilities for global nutrition, the protection of the climate, efficient use of resources and the environment.

# What is a Bioeconomy?

## Consumer

- *socio-economics*
- *logistics*
- *construction*
- *trade*



*Systems  
analysis*

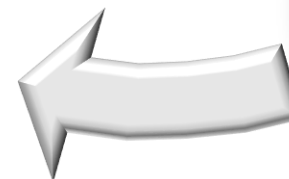
## Production

*agri-tech  
(mol.) biology,  
soil, plant, animal*



## Conversion

- *process tech*
- *biotechnology*



## Valorisation

- *food, feed*
- *fiber,*
- *fuel*



*Sustainable?*

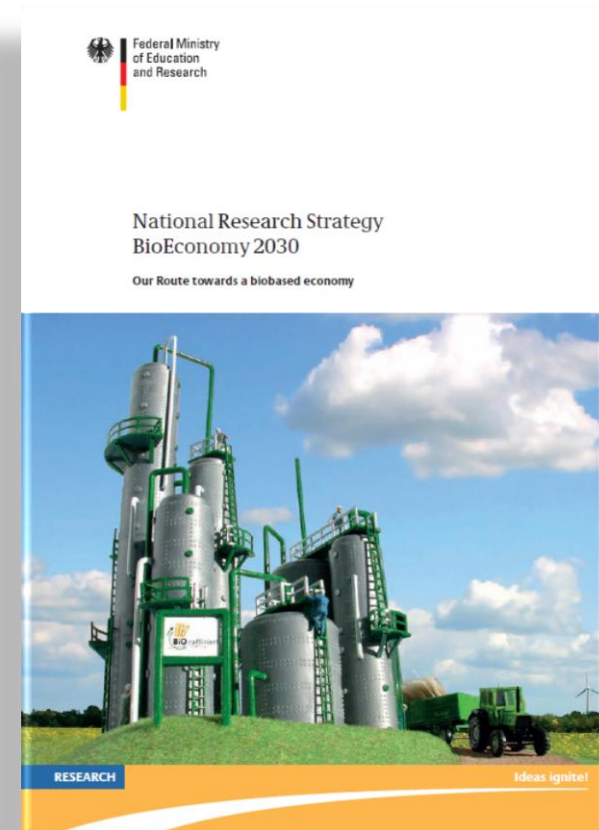


# National Research Strategy Bioeconomy 2030

## NFS 2030

Starting November 2010; duration 6 years

Project funding	1 457 Mio €
Institutional funding	976 Mio €
<b>Total funding</b>	<b>2 400 Mio €</b>





# Bioeconomy Council

Phase I: January 2009 – May 2012

Phase II: since Sept. 2012



- **Advising the federal government**
- **Social dialog**
- **Recommendations for funding in education, research and development.**

# NFSB 2030 – Implementation I: Lines of Activity

**Securing  
global nutrition**



**Using renewable  
resources for  
industry**



**Sustainable  
agricultural  
production**



**Developing  
biomass-based  
energy carriers**



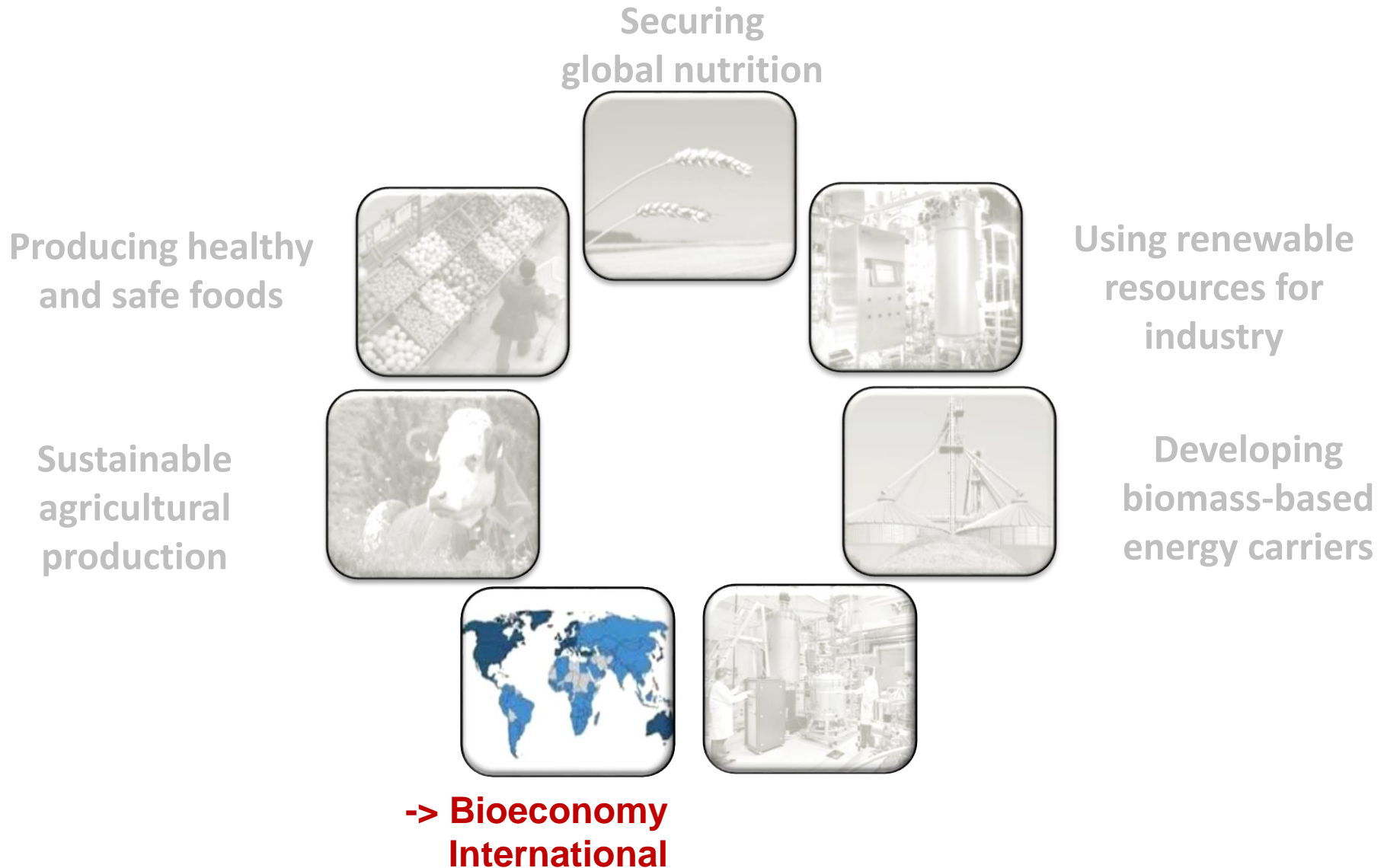
**International  
Cooperation**



**KMU, GoBio  
Bioeconomy Cluster**



# NFSB 2030 – Implementation I: Lines of Activity

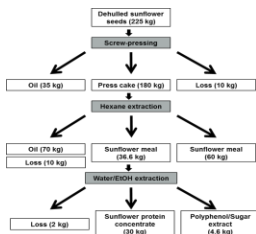


# Bioeconomy International

## Overall Concept

- **Implementation of bioeconomy in a global context**
- **R&D projects to relevant subjects in bioeconomy**
- **Composition of consortia entirely flexible:**
  - Industry,
  - University or
  - Research organizations
- **Brazil among 8 preferred partner countries**
- ✓ **3 Calls since 2013**
- ✓ **227 Proposals submitted**
- ✓ **55 Projects selected for funding**
  - ✓ **10 projects (18%) with partners from Brazil**
- ✓ **37 Mio € funding in Germany**

# Sustainable food production of the future: Fraunhofer Institute for process engineering and packaging

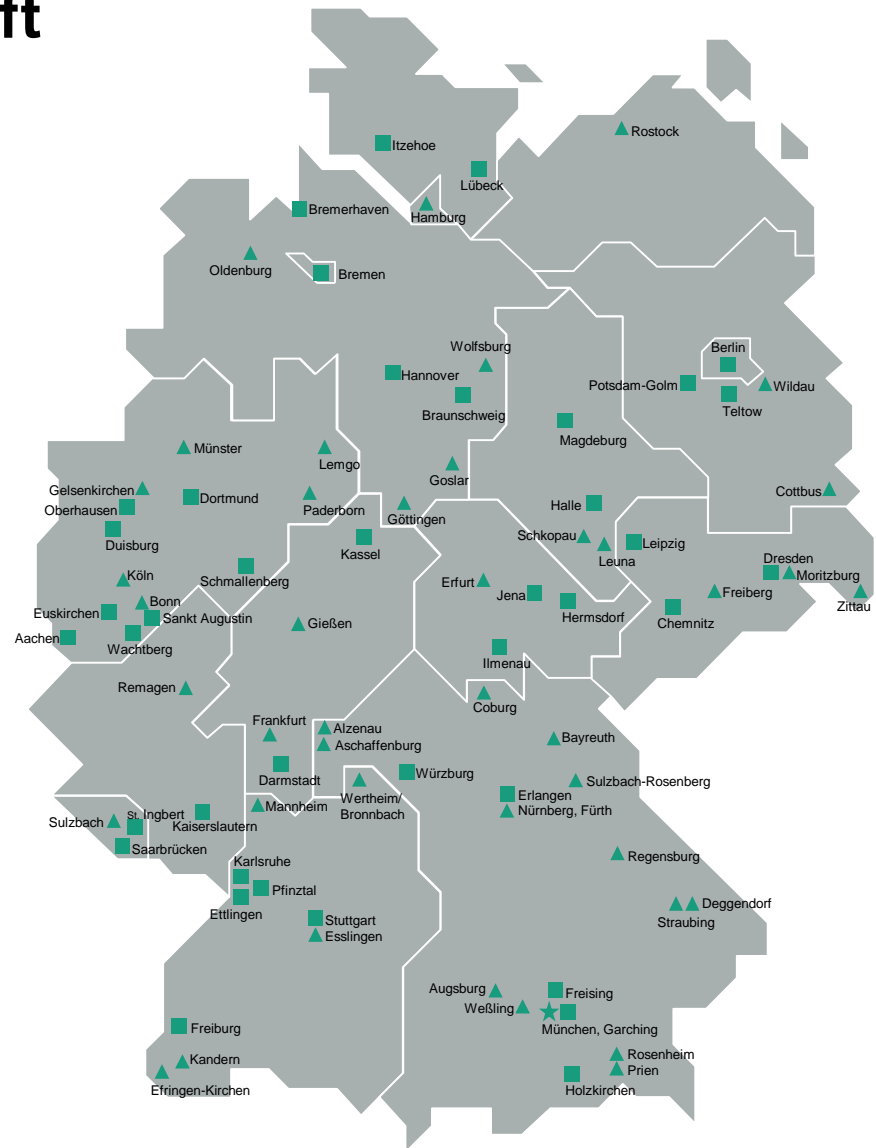


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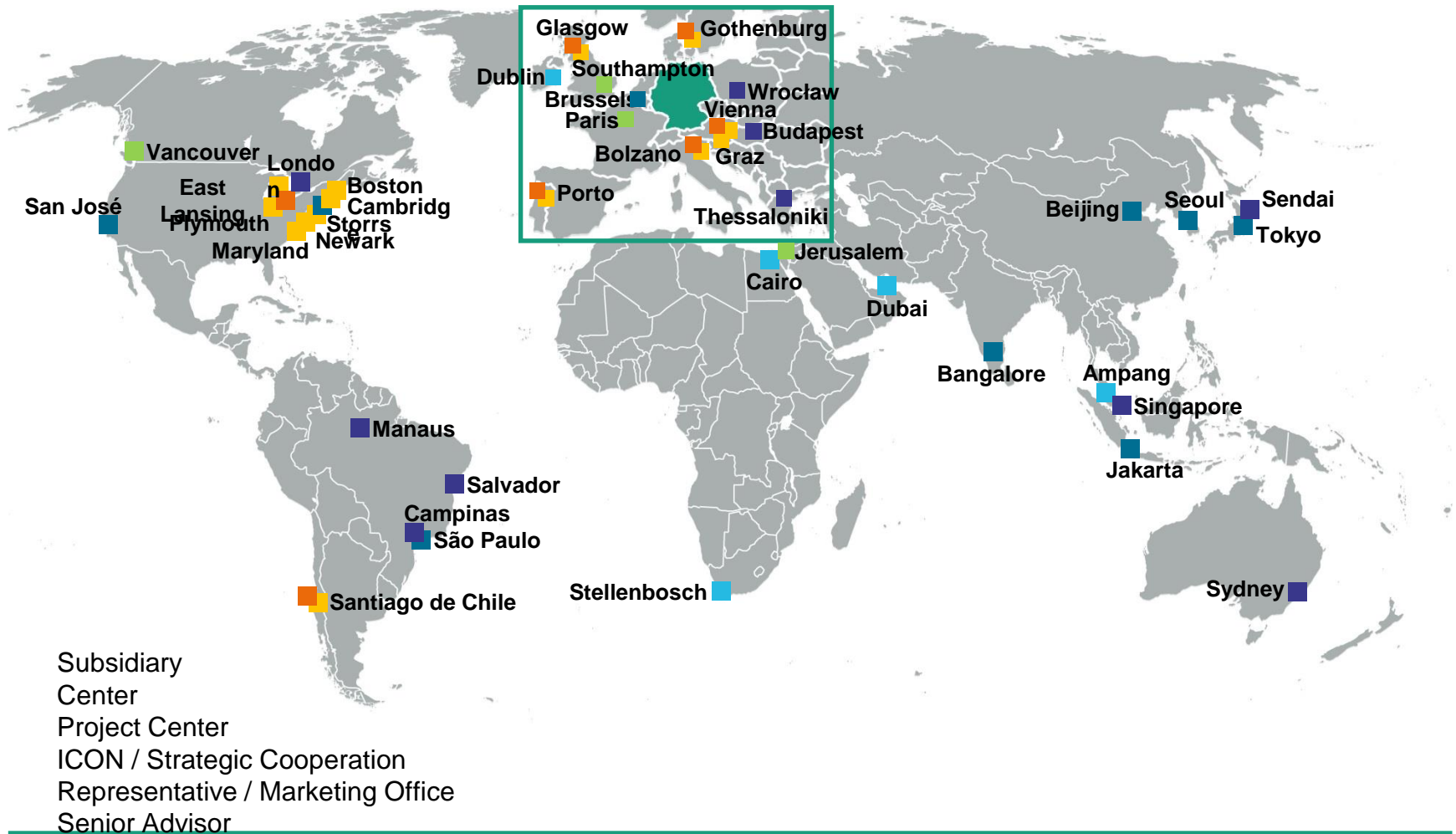
# The Fraunhofer-Gesellschaft

## Applied contract research

- Largest applied research organization in Europe
- 67 institutes and research units
- More than 23,000 staff
- €2.1 billion annual research budget
  - ~70% is generated through contract research with industry & specific governmental projects
  - ~30% is sourced from the federal & state grants
- International cooperation



# Fraunhofer Gesellschaft Worldwide





# Fraunhofer Institute for Process Engineering and Packaging IVV – Business Fields



Biogenic Raw Materials



Functional Ingredients



Food Processes and Products



Food Quality and Sensory Acceptance

Compliance of Packaging Materials



Functional Materials



Processing and Packaging Machinery



Recycled Plastics





# Top 10. nutrient containing agriculture products in worldwide harvests (FAO 2013)



Product <sup>**)</sup>	Amount t/a	Energy kcal/a	kcal per human and day <sup>*)</sup>
1. Maize	1,016,736,092	$3.3 \cdot 10^{15}$	1276
2. Rice	745,709,788	$2.6 \cdot 10^{15}$	993
3. Wheat	713,182,914	$2.5 \cdot 10^{15}$	950
4. Soybeans	276,406,003	$1.2 \cdot 10^{15}$	469
5. Palm oil	55,800,940	$5.0 \cdot 10^{14}$	191
6. Barley	144,755,038	$4.7 \cdot 10^{14}$	179
7. Sugar cane	1,877,105,112	$4.7 \cdot 10^{14}$	179
8. Rapeseed	64,563,586	$3.6 \cdot 10^{14}$	138
9. Potatoes	368,096,362	$2.8 \cdot 10^{14}$	108
10. Sorghum	61,384,559	$2.1 \cdot 10^{14}$	82

<sup>\*)</sup> based on  
7.2 bn humans

**4,531**  
*kcal*  
*human day*

Source: <sup>\*\*)</sup> FAO-STAT, Data from 2013 and 2012

**TOTAL (141 Products):  $1.47 \cdot 10^{16}$  kcal/a: ~ 5,460 kcal/human and day**

**Total use of these products for human nutrition (2,250 kcal/d)**

**harvests 2013:  
enough food to feed 17 billion (vegan) people!**



# Limitations in food production



- Food-waste along the value chain
  - >100 Mio. tons in the EU<sup>\*\*</sup>)
  - 33% worldwide along all value added chains<sup>\*\*</sup>)



- Production of animals  
(Ressource-factor~1:5)

■ Meat <sup>*)</sup> :	308 Mio. t/a
■ Milk <sup>*)</sup> :	753 Mio. t/a
■ Eggs <sup>*)</sup> :	81 Mio. t/a
■ Fish from aquaculture <sup>*)</sup> :	67 Mio. t/a



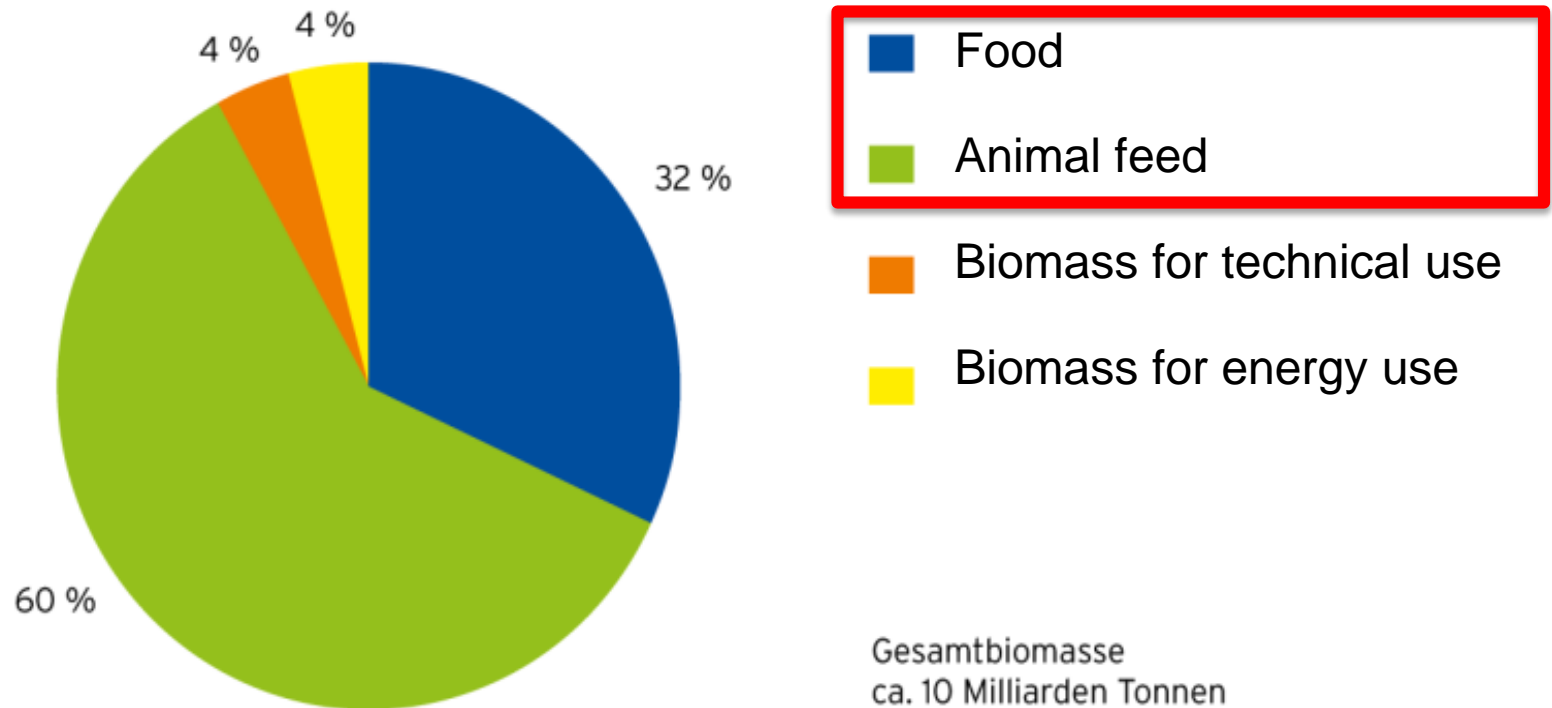
- Use of food for energy and bioeconomy

Sources:

<sup>\*)</sup> FAO-STAT, Data from 2012

<sup>\*\*</sup>) European Commission, 2014

# Worldwide use of agricultural products



Source: (UBA 2014, Thrän 2015)

# Possible solution: Integrated use of vegetable raw materials and food byproducts

Vegetable raw materials  
Protein- and Oilseeds  
/ Sidestreams /e.g.  
presscake

Production  
Purifying

High valuable **food and feed ingredients**

**Technical raw materials**

**Bio-energy from waste**



Lupins, sunflower, soy,  
rapeseed, pea, linseed, cereals and  
by-products from food industry



Proteins, fibers, lipids,  
secondary plant metabolites



# Plant based meat alternatives

## Challenges: lack of taste and texture

Beef



Chicken



Porkn



Tofu



Tempeh



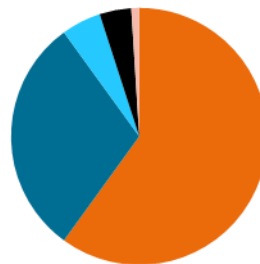
Seitan



# Technology: High moisture extrusion cooking (HMEC)

- Research started in late 80's
- Fibrous muscle-meat texture
- Fresh product, 50-80% water

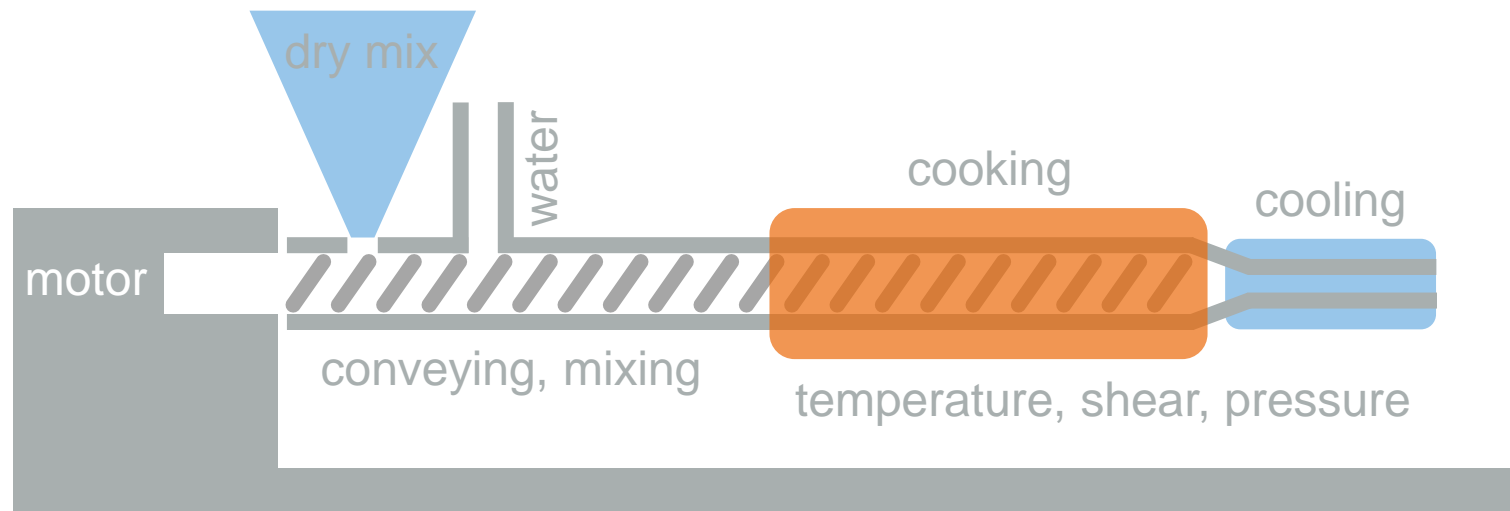
Ingredients



- Water
- Protein
- Fiber
- Starch



Extrudate with fibrous structures



# Implementation in European market

## Plant based meat alternative products



Midori Pulled



Midori Stripes

# Current projects with companies from Brazil and Germany



- **SunPro:** Duration: 2014-2017  
Production of functional protein ingredients from by-products of sunflower oil production.



- **Acrowards:** Duration: 2016-2019  
Establishing Macaúba as new oil plant by integrated fractionizing of Macaúba-fruits to food ingredients and technical products.



- **ByProFood:** Duration: 2016-2019  
High valuable food ingredients and foods from by-products from the processing of coffee, banana and mango.



- **SeaFeed:** Duration: 2016-2019  
High-valuable protein ingredients from seaweed and applikation of ingredients in food and feed products.





# Centro de Projetos Fraunhofer para Inovação em Alimentos e Recursos Renováveis no ITAL

2013 - 2018



**ITAL**

**Fraunhofer**  
IVV



400 m<sup>2</sup> Laboratories and technical Plants

## Management:



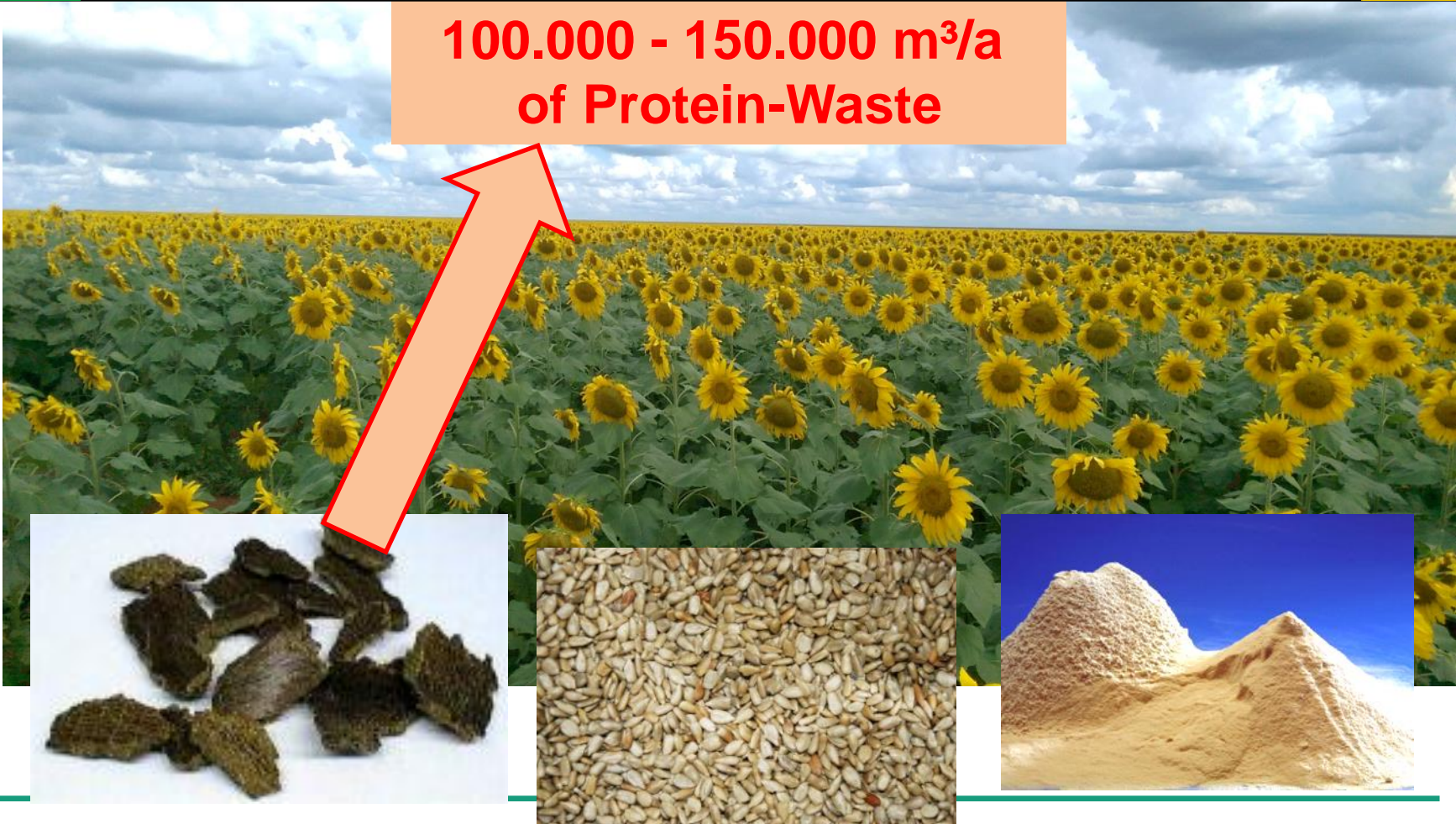
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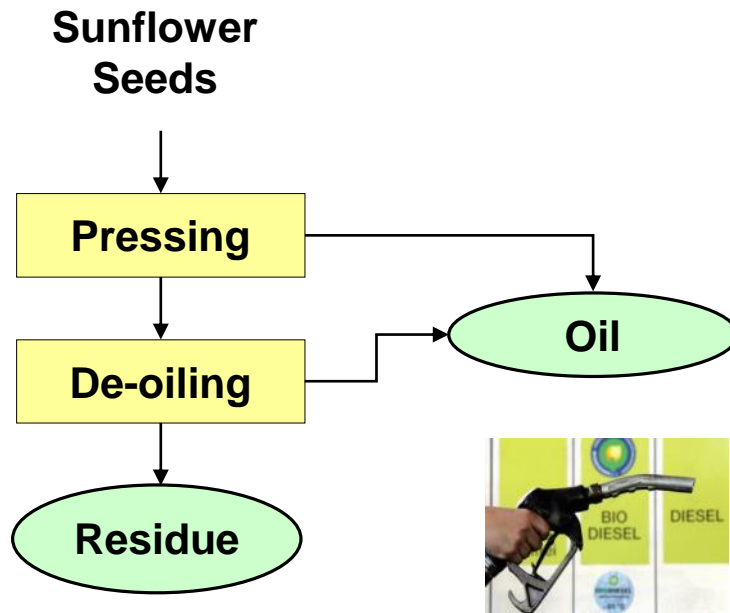
**Dra. Roseli Aparecida Ferrari**  
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019 3743 1774



100.000 - 150.000 m<sup>3</sup>/a  
of Protein-Waste



# Short overview of the SunPro-project: Sunflower Seeds – Present Use



Sunflowers



Sunflower Seeds



De-oiling residue

Low  
valuabl  
e  
Animal  
Feed



## Motivation

- Brazil is the largest producer of coffee and the third largest producer of fruits in the world
- ~ 50% of the production is lost along the value chain
- High economic potential of fruit residues and by-products such as peels, skins or seeds



## Aim

- Total valorization of fruit waste by developing functional and tasty food ingredients, flavors and colorants
- Raw materials: mango-, banana- and coffee-peels
- Develop processing technologies to preserve valuable constituents and introduce new functionalities into the ingredients

## Seaweed:

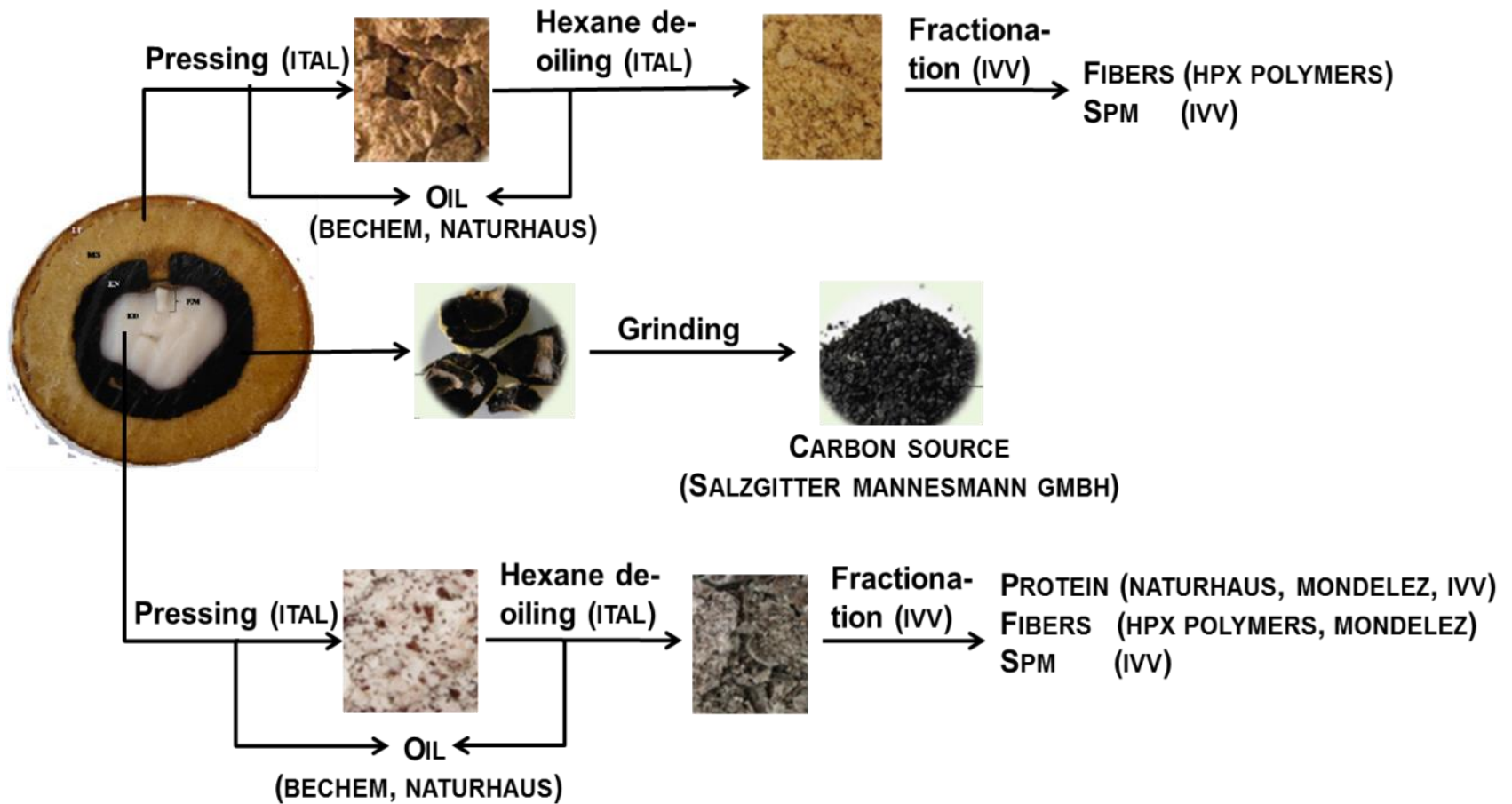
- Cultivation and farming in relevant amounts
- Identify suitable seaweed species for sustainable and economic lifecycle in Brazil
- Find best growing conditions and use of selected seaweeds
- Perceive best farming practices for selected seaweeds



## Processing and application:

- Identify suitable extraction process
- Diminish marine off-flavors by extraction
- Develop adequate fractionation techniques for chicken feed and food ingredients
- Evaluation of meat quality
- Identify best application

# Utilization of Macaúba palm fruits



# Planned future projects with companies from Brazil and Germany



- **CocoaFruit:** Duration: 2017-2020

Complete utilization of cocoa fruits by recovery of the aromatic cocoa pulp for food applications and husk utilization.



- **EcoBacu:** Duration: 2017-2020

Fractionation of Babaçu palm fruits and utilization in food and packaging applications



- **SusProCaschew:** Duration: 2018-2021

Valorisation of residues from cashew nut production through development of new sensory attractive food ingredients



# Mission



- **Create “Innovations made in Brasil and Germany” in Bio-Economy-** Joint generation of knowledge in the field, realize value added innovation in Brasil and Germany and marketing the products worldwide.
- Delivering the basis for **creating new jobs in Brasil and Germany** in agriculture, food industry and energy/chemistry sector.
- **Support partnerships between German and Brazilian companies** doing joint research, joint industrial production and marketing.
- **Developing sustainable products and integrated processes to reduce food waste and to maximize value added** in partnership with German and Brazilian companies.



# Thank you very much

