

SAHYOC Stakeholder Workshop

EU – India Cooperation on Biomass and Bio-waste Research and Development

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Bella Center

Copenhagen

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***The Industry of Bio-Waste Digestion in Europe,
Feedstocks, Costs and Benefits***



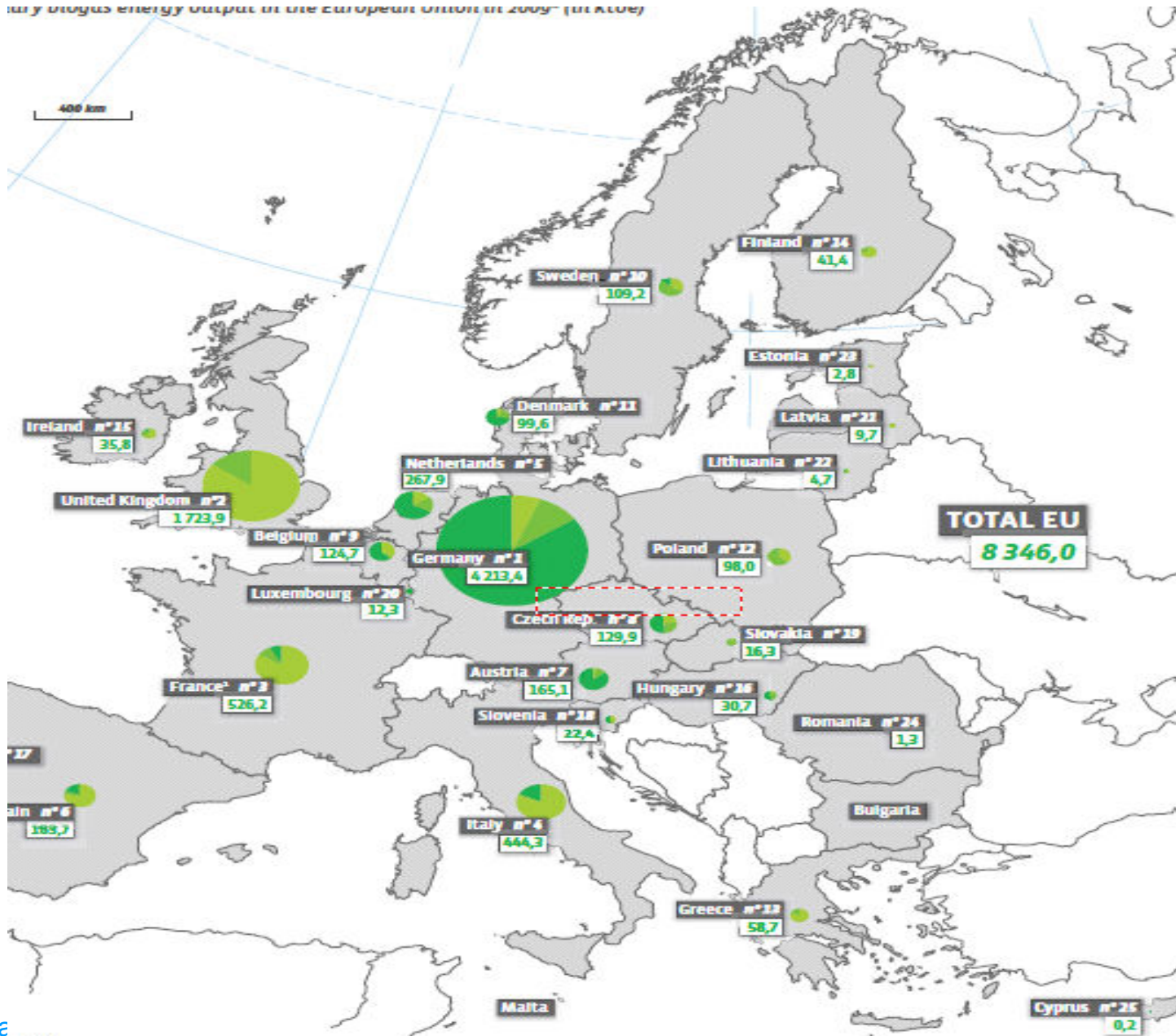
Internationales
Biogas und
Bioenergie
Kompetenzzentrum

Activities of IBBK related to Biogas technology

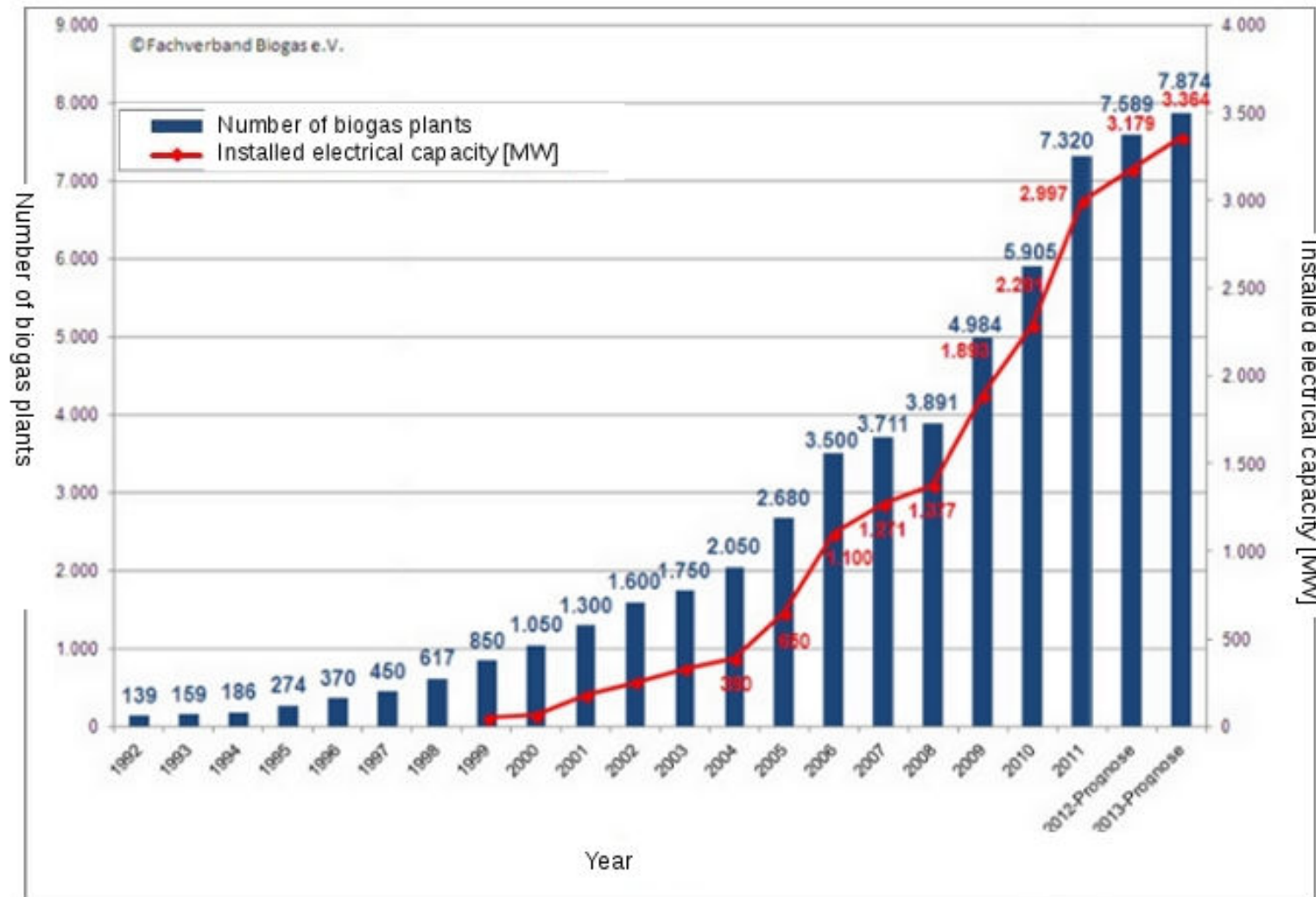
- Know-How transfer (international workshops, conferences, study tours, training)
- Technical support especially with dry digestion, lagoon technology, small scale installations
- Contacts to experts in planning, design and construction
- Contacts to specialized companies
- Networking with members in different regions nationally and internationally



Biogas energy output in the European Union in 2009 (in ktce)



Increase of the number of biogas plants in Germany related to changes in laws and regulations



Biogas in Germany 2013 (forecast)

<i>Amount:</i>	7.874 Biogas Plants (Agricultural and Comunal)
<i>Installed electrical capacity:</i>	3.364 Megawatt (~ 3,4 Gigawatt)
<i>Power production:</i>	22,63 Mrd. Kilowatt hours = Electricity for 6,5 Mio. Households
<i>Agricultural Area for energy crops:</i>	ca. 850.000 ha for Biogas
<i>Feed into the natural gas grid:</i>	112 Biomethane feed in stations (105 Mio. m³/a)
<i>Biogas filling stations:</i>	119 with 100% Biomethane, 288 with 10-50% biomethane
<i>Employment places:</i>	ca. 40.000

German Renewable Energy Act (EEG) 2012

Feed-in tariffs for biowaste digestion plants [ct/kWh]

Conditions:

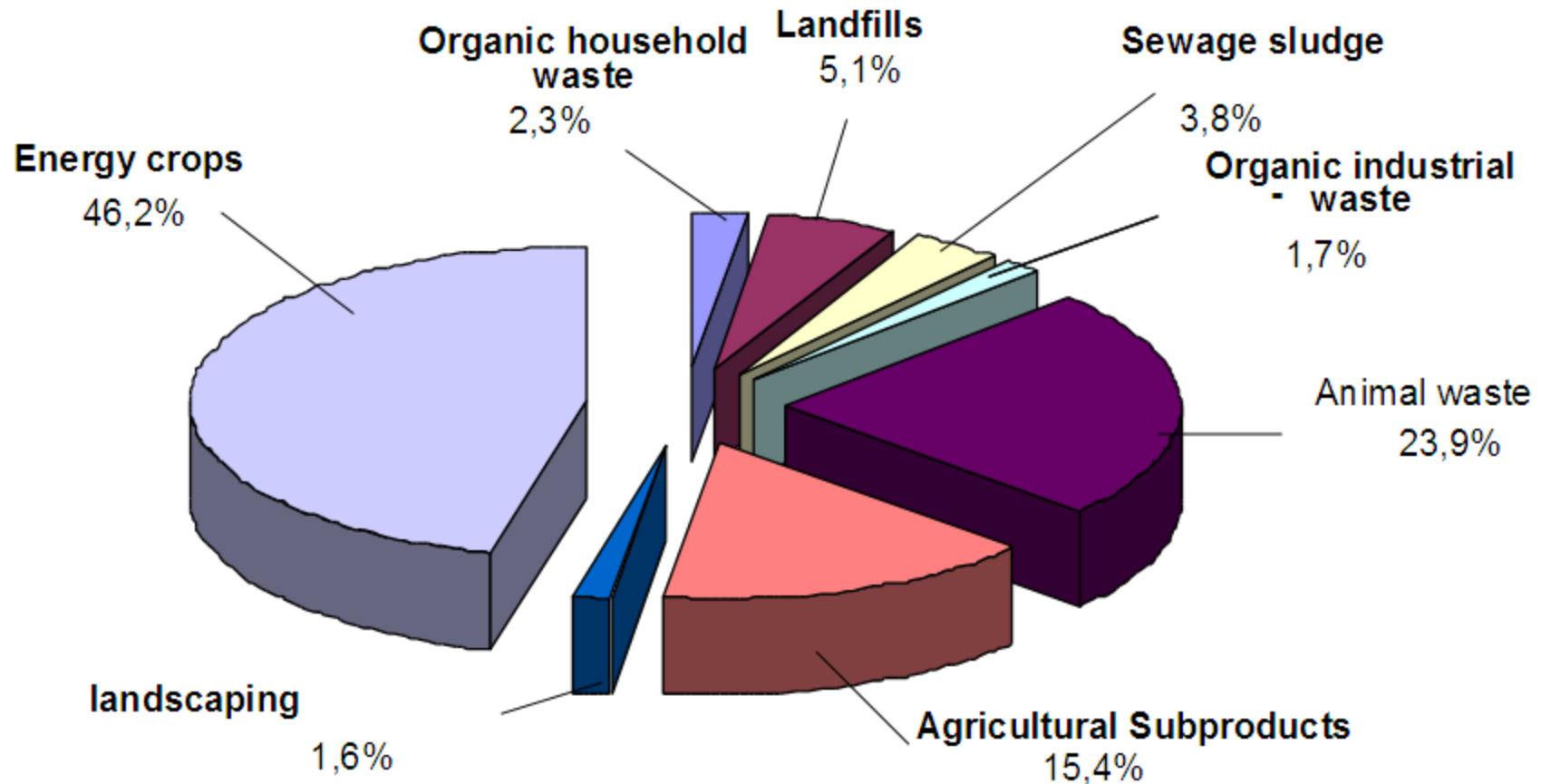
- Min. 90 % biowaste (official definition)
- Post-treatment through composting process

Installed capacity	EEG 2012	EEG 2009
0-150 kW	16,00	11,32
151-500 kW	16,00	8,91
501-20 000 kW	14,00	8,00

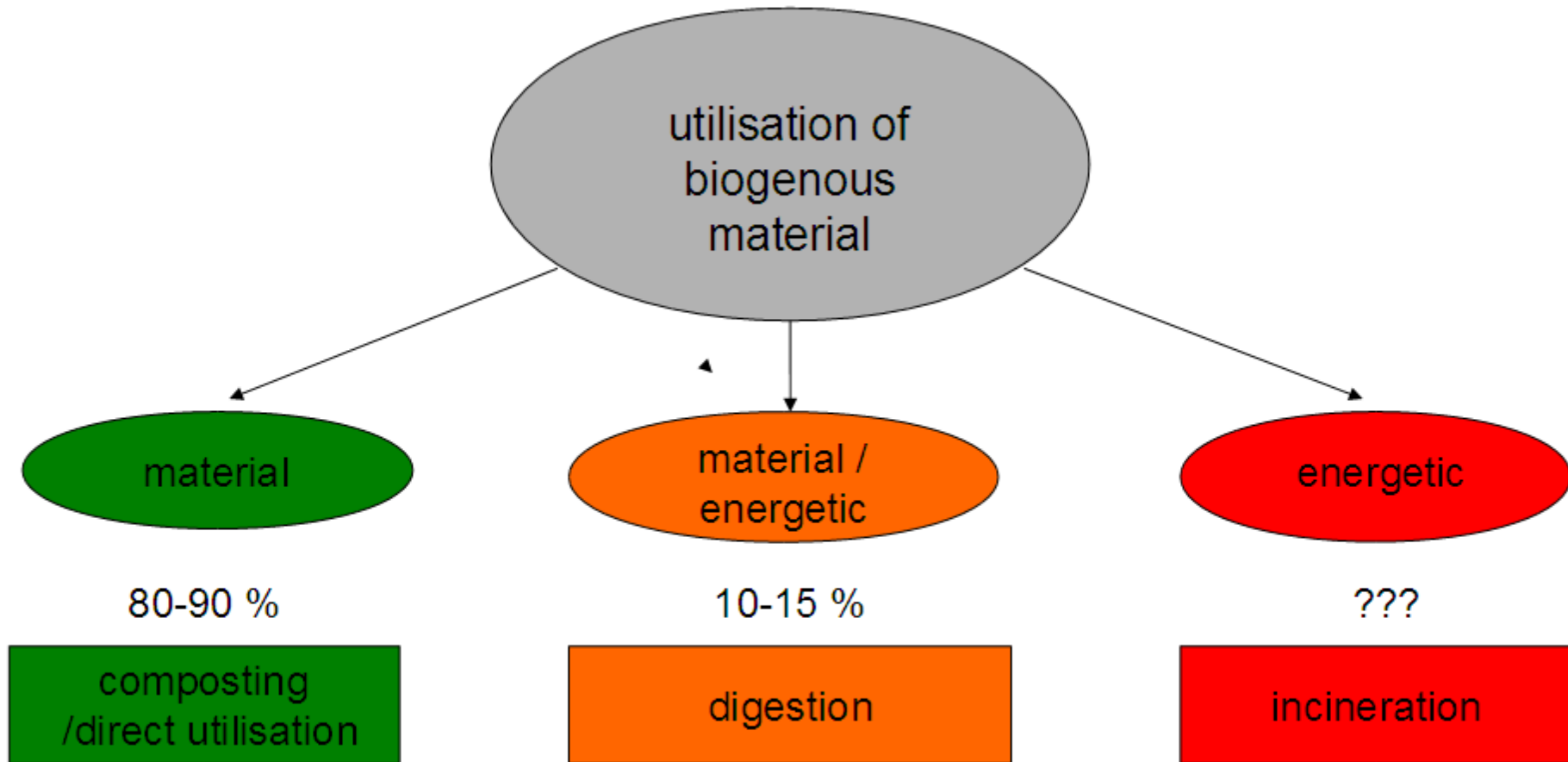


Feedstock for Biogas Production in Germany

In total: 24 Bln m³ Biogas: 50 Mio. MWh electricity and 72 Mio. MWh heat



Utilisation of Biowaste



ca. 1.000 composting plants
11.2 Mio. capacity / a

ca. 85 anaerobic digestion plants
1.7 Mio. capacity / *a

?

*= incl. CO digestion, 50% dry fermentation



Biowaste versus Energy Crops

Energy maize – Bio-waste

Gas yield: 1 ha energy maize
(45 t FM) = **ca. 70 t bio-waste**



Collected household bio-waste quantity in Germany:

ca. 4 Mio. t bio-waste

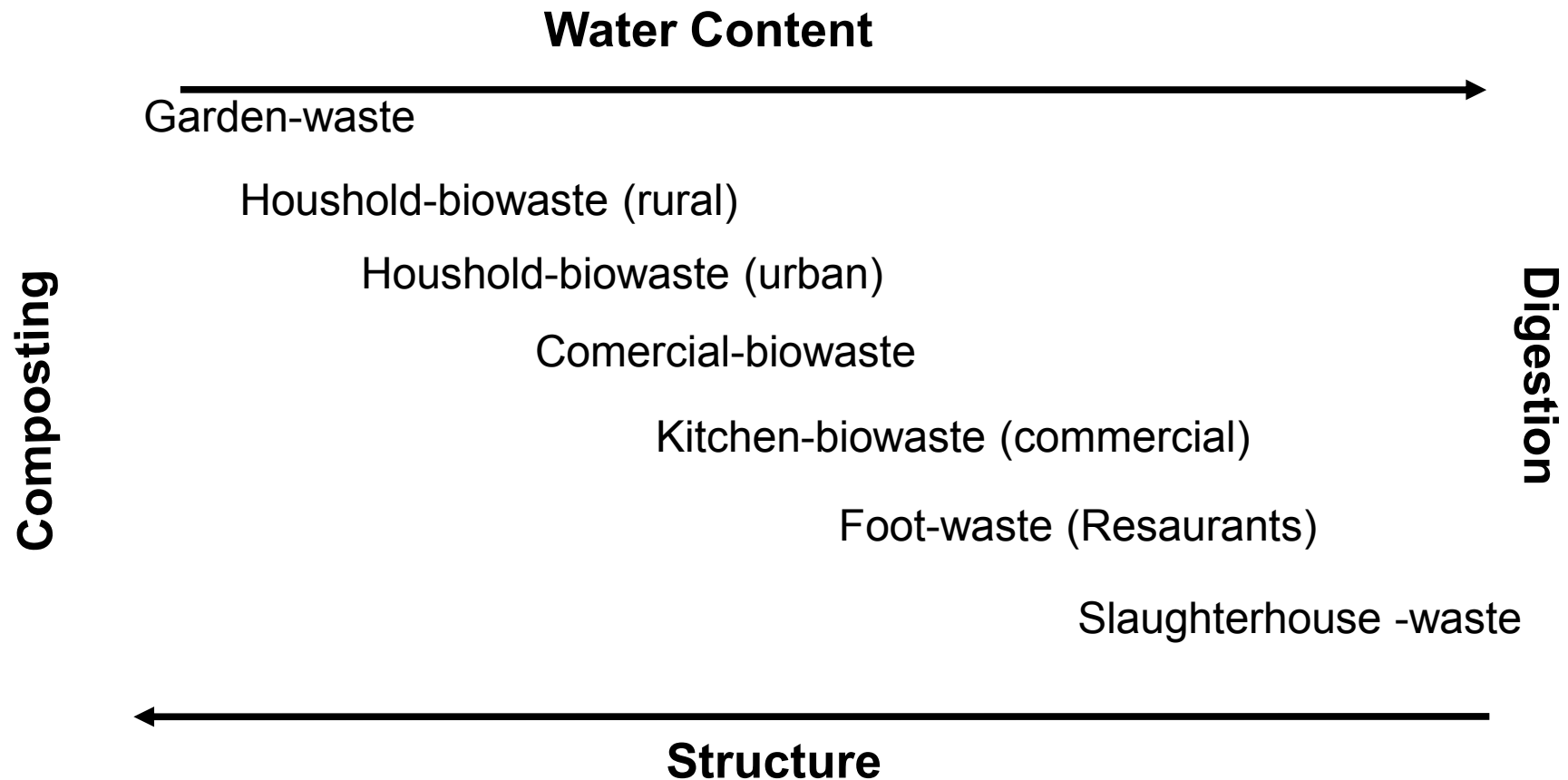


Corresponding gas yield of:

= ca. 2,6 Mio. t energy maize
= ca. 55.000 ha energy maize

Choice of treatment technology

According to Water Content and Structure



Biowaste Treatment Technologies

Biowaste Dry Fermentation – Process Overview

Continuous processes

1.1 Linde KCA/Strabag – process (Germany)

Horizontal concrete digester with several paddle stirrers in row, requires thorough crushing and pretreatment of organic wastes, max 25% DM

1.2 DRANCO - process (Belgium)

Vertical cylinder, thorough crushing of organic wastes, mixing with already digested matter 1:6, vertical passage from top to bottom through cylinder

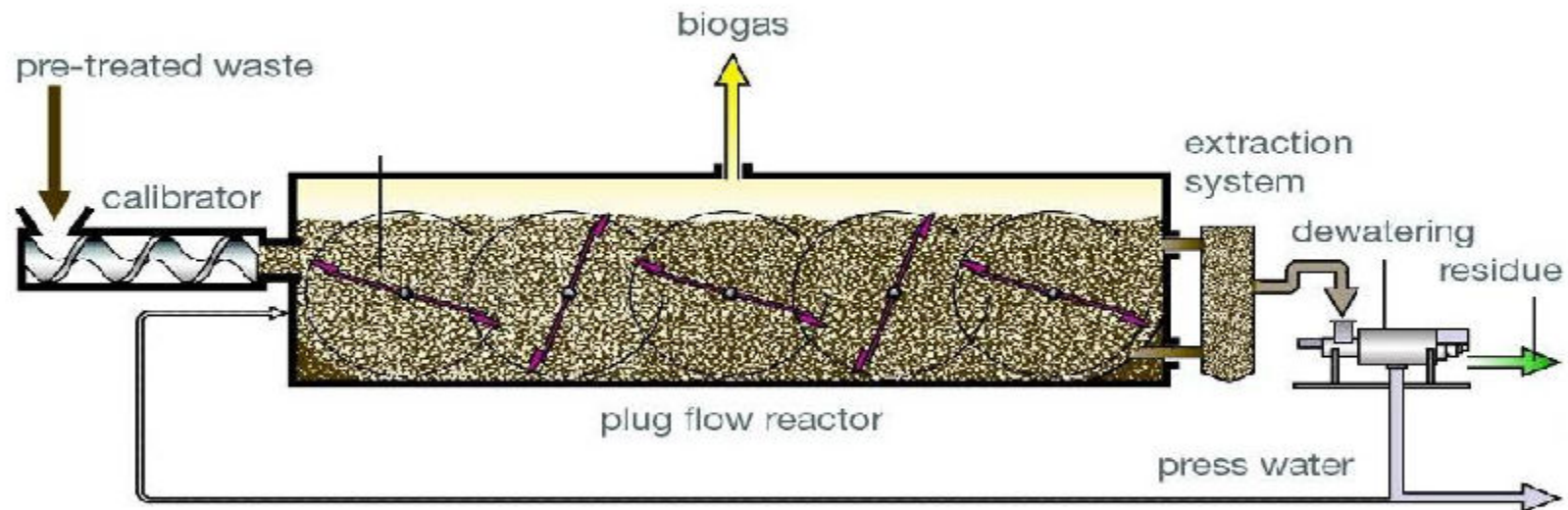
1.3 Kompogas - process (Switzerland), Thöni (Austria)

Horizontal steel or concrete digester with longaxle paddle stirrer, requires thorough crushing and pretreatment of organic wastes, max 25% DM



Continuous Biowaste Digestion

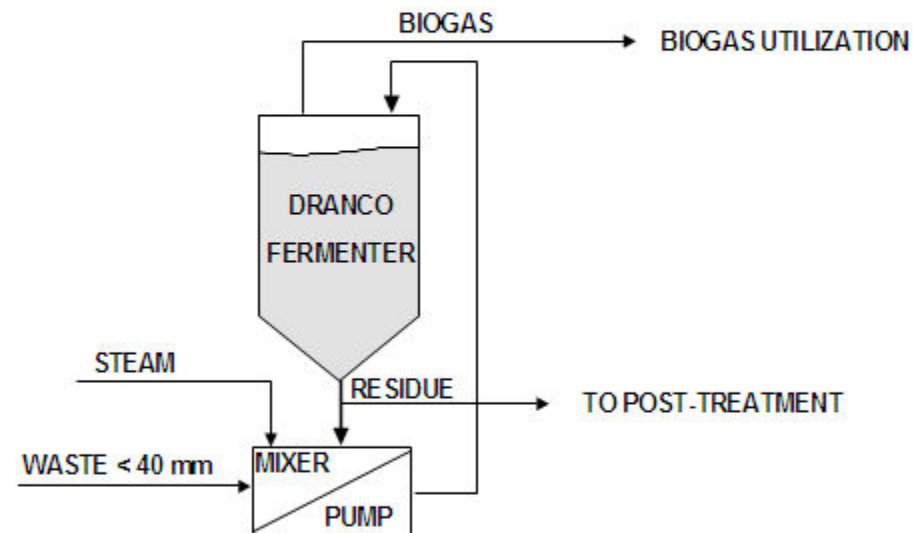
Strabag Umweltanlagen GmbH (formerly Linde-KCA Umweltanlagen GmbH)



- About 20 dry fermentation plants in operation
- The dry digester built as a horizontally arranged, special-concrete, very sturdy compartment.

Continuous Biowaste Digestion

Organic Waste Systems (DRANCO)



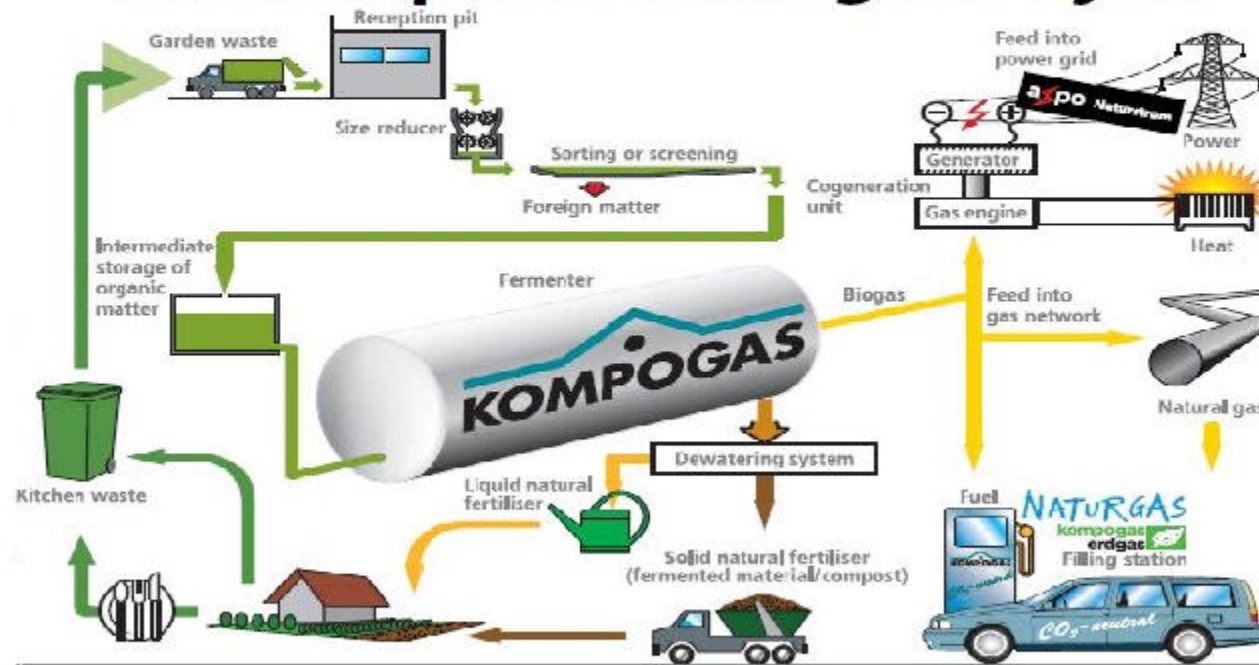
- **First plant built in 1984; almost 20 full scale plants and 7 demonstration plants**
- **Vertical digestion, material drops vertically by gravitational force**



Continuous Biowaste Digestion

Axpo Kompogas AG

The complete ecological cycle



- The volume of each digester is 1300m³
- Retention time in the fermenter is about 14 to 20 days



Biowaste Treatment Technologies

Biowaste Dry Fermentation – Process Overview

Discontinuous processes (industry standard)

2.1 Garage type digester (communal)

Inoculation of substrates and percolation with process water (Biocell, Netherlands; BEKON, Bioferm, DeNaBa, Germany;
Additional aerobic pretreatment (Kompoferm, Germany; Solon, Denmark; Pöttinger, Austria)

2.2 Simultaneous wet-dry digestion (agricultural and communal)

(Loock and BAL, Germany; Renergon, Switzerland)

2.3 Solid matter immersion process with flexible cover (agriculture)

(Erep, Switzerland; Aria – Biogas; France, Wolferstetter, Germany)



Biowaste Treatment Technologies

Biowaste Dry Fermentation – Process Overview

Discontinuous processes (new developments, trials)

2.4 Plastic tube reactor (agriculture research)

Pilot plants (Budissa AG, Triesdorf – Germany)

2.5 Digestion of percolation liquid (agricultural, communal)

Collection of substrate with mobile digester, thermophilic hydrolysis (Portagester, UK)



Batch Biowaste Digestion

Bekon Energy Technologies GmbH & Co.KG



- 15 plants with Bekon System in operation in Germany, Switzerland and Italy
- The standard module has 4 digesters
- The fermentation process: 28 - 35 days



Batch Biowaste Digestion

BIOFerm GmbH



- **30 biogas plants in Germany**
- **Biggest plant: 8 digesters and a capacity of 750kWe**
- **Substrate is fermented during four weeks**



Batch Biowaste Digestion

Eggersmann Anlagenbau GmbH & Co.KG



- 8 plants in Germany, all running on organic municipal waste
- The standard module has 8 digesters
- 21 day for fermentation process => pre-process for composting
- Biggest plant in Hamburg with 70.000t/a source separated biowaste



Batch Biowaste Digestion

Modular constructed digesters

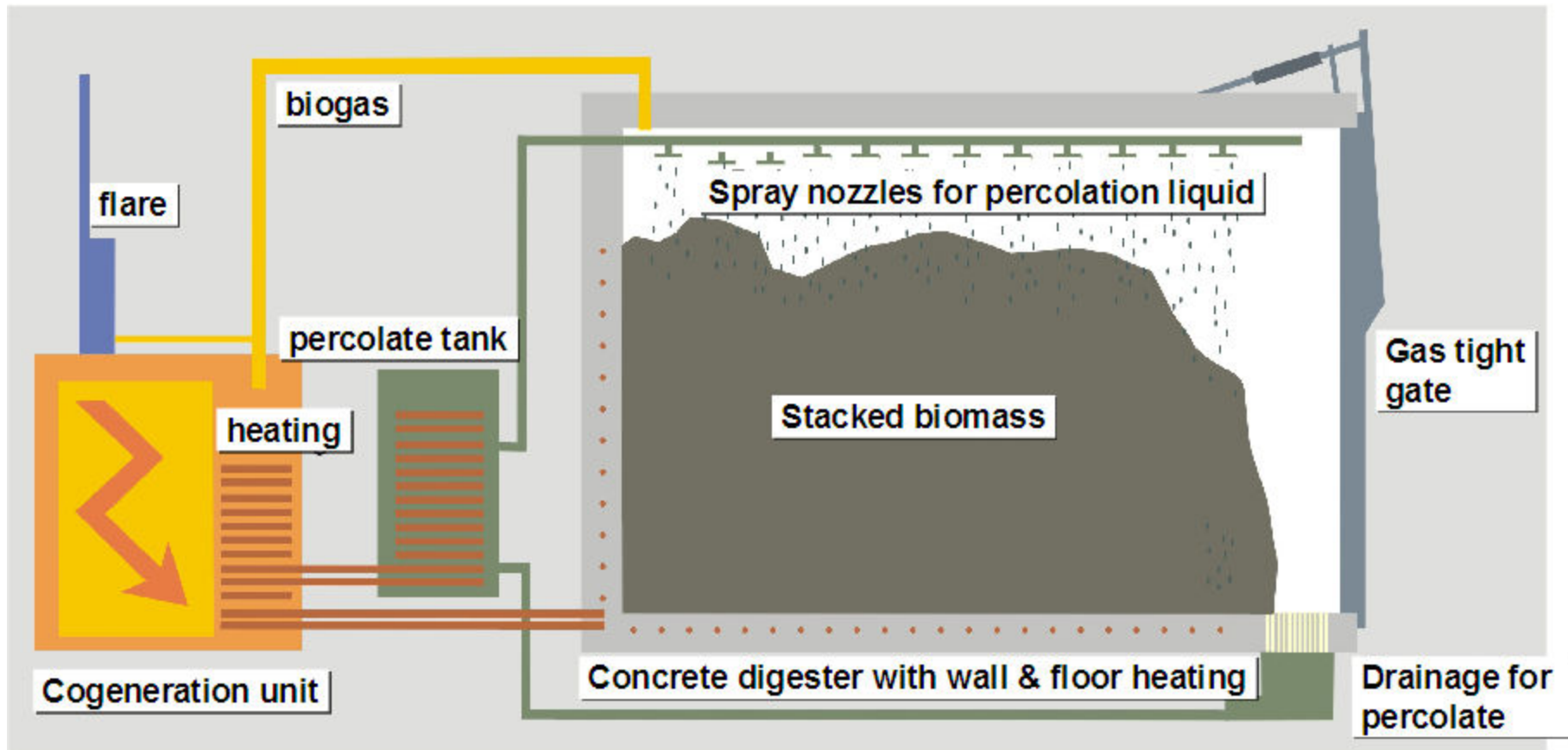


Renergon Dry Fermentation Plant, Langenau, Germany



Batch Biowaste Digestion

The process of dry digestion with percolation



Batch Biowaste Digestion

Technical success factors for biowaste dry digestion systems

- Substrates need to be suitable for dry digestion (stackable, structured)
- Thorough inoculation of input substrates is essential
- Active bacteria have to be transported to the fresh substrate (in contrast to wet digestion where fresh biomass is transported to active bacteria)
- Digestion process has to support the development of appropriate bacteria
- Applied technology has to suit local conditions
- Plant size has to be designed according to available amounts of input substrates
- Modular design concept allows future enlargement of biogas plant



Batch Biowaste Digestion

Economical success factors for biowaste dry digestion systems

- Continuous supply of suitable substrates (stackable, structured)
- Fixed long term waste disposal contract
- Revenue from waste disposal fees, e.g. in Europe 20 – 120 €/t
- Access to the electricity grid at reasonable rates
- Revenue from biogas or electricity sales
- Possibility to utilize excess heat from CHP unit
- Investment costs between 5000 and 10.000 €/kW installed capacity
- Revenue from sales of compost or dried digestate as secondary fuel



Thank you for your Attention!

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