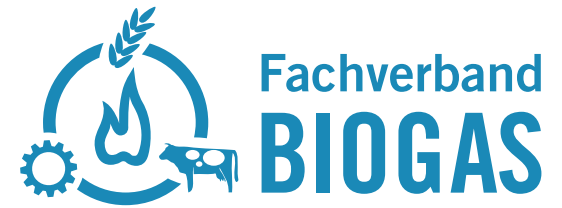


Asia Clean Energy Forum 2016
7th June 2016, Manila Philippines

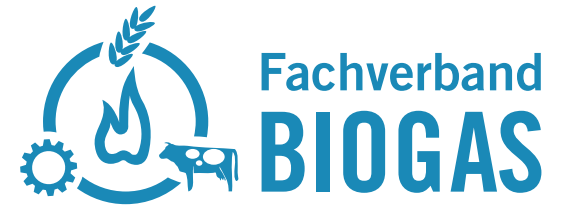


Biowaste to Biogas!

Florian Strippel
Department Waste, Fertilisation and Hygiene

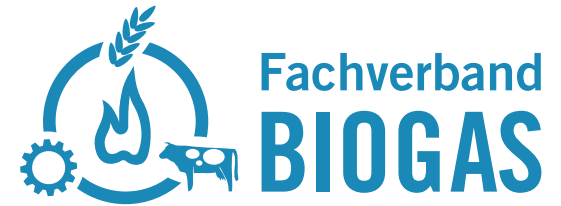


Agenda

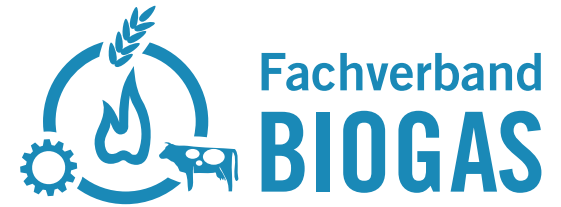


- Structure of the German Biogas Association
- Possibilities of biogas production
- German biogas market
- Commonly used techniques for the anaerobic digestion
- Digestate application

German Biogas Association

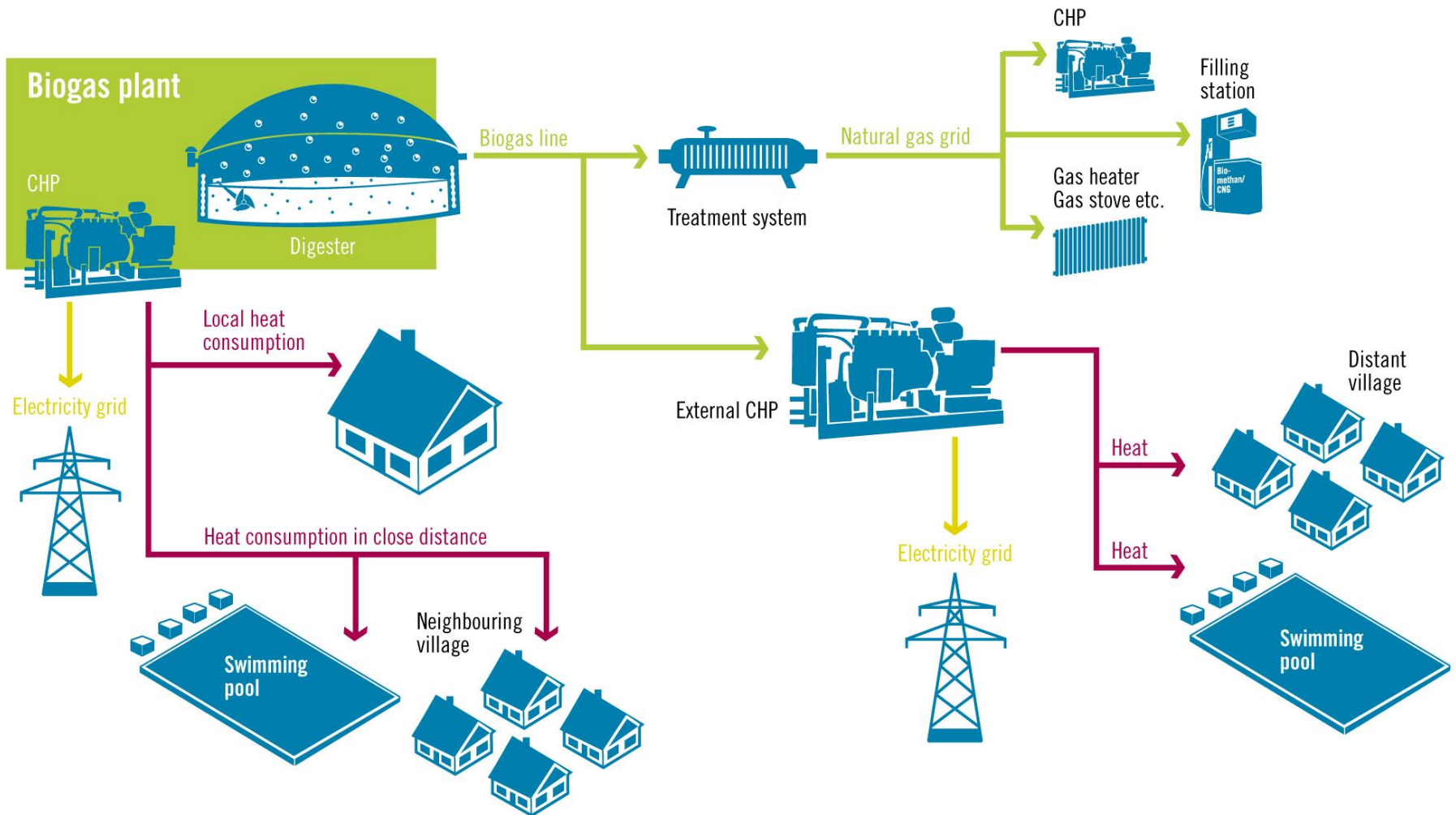


Possibilities of biogas production (I)

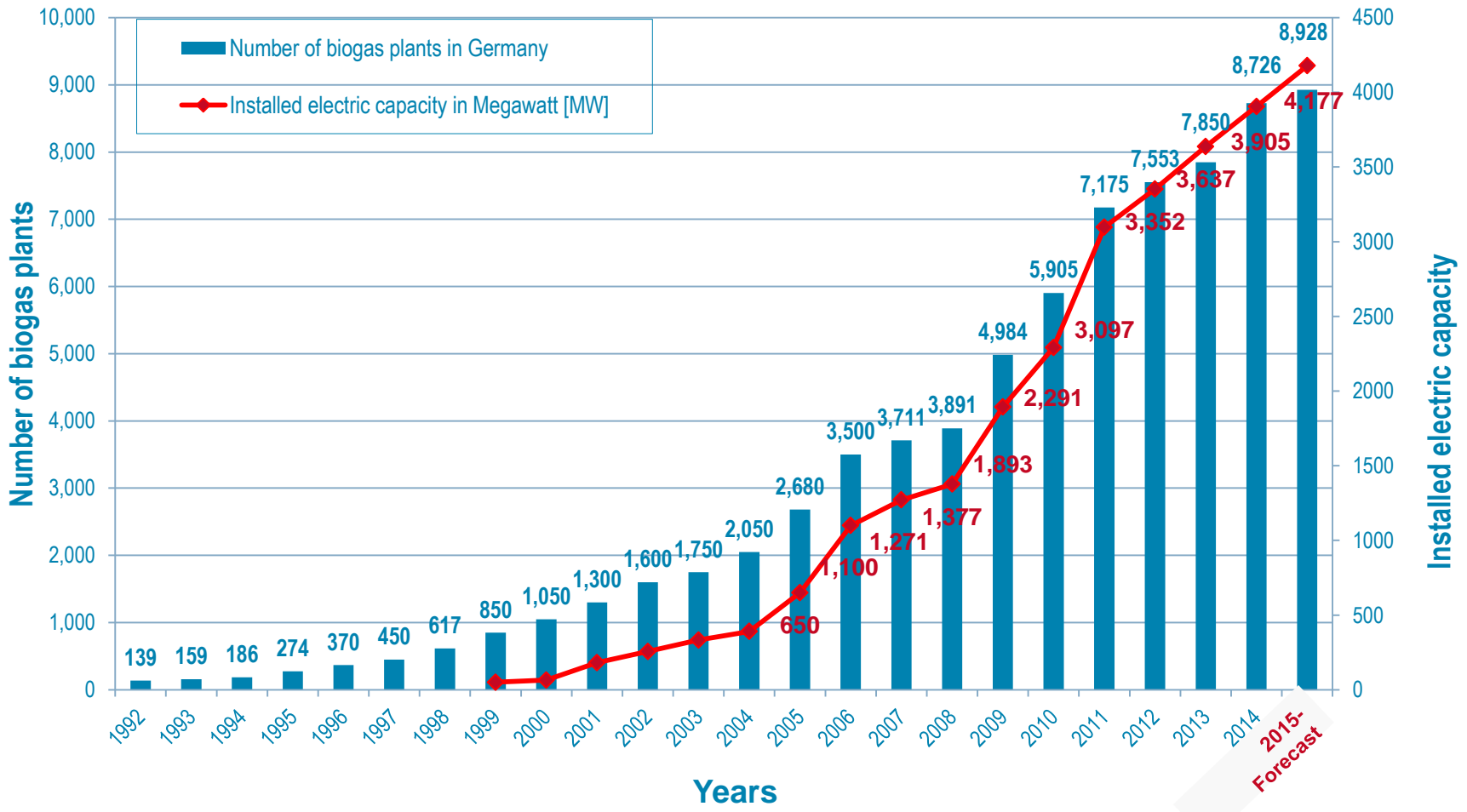


- CO₂ neutral energy production by the digestion of organic waste
- Production of a primary energy source which is available for manifold applications
- If used for electricity production: Flexible application and easing the strain of electricity grids
- Especially in developing countries utilisation by cooking, heating and gas lighting
- Improvement of the standard of living by the reduction of the waste volume
- Production of humus rich fertiliser and closing of the nutrient circles

Possibilities of biogas production (II)



Development of the stock of German biogas plants (11/2015)

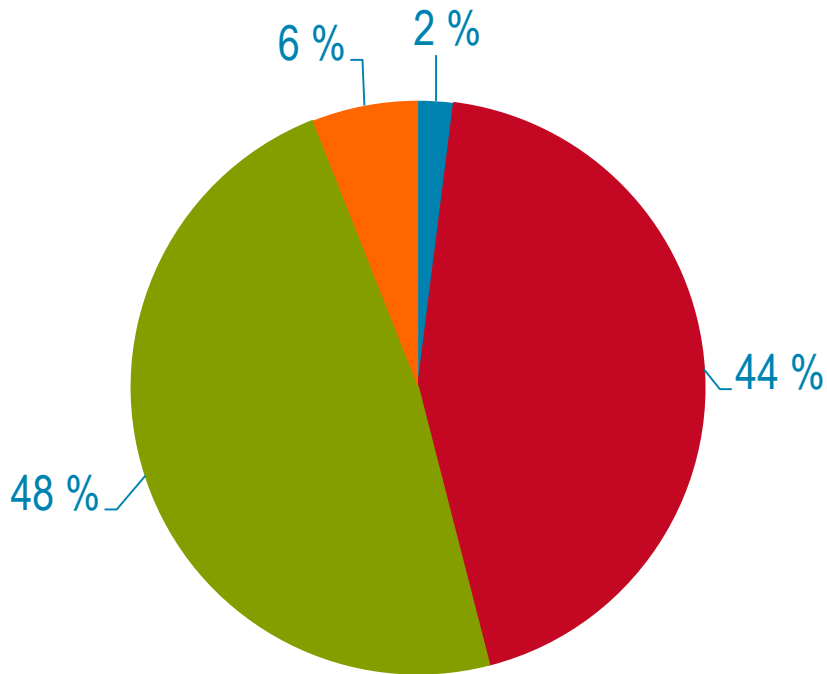


Feedstock used in German biogas plants

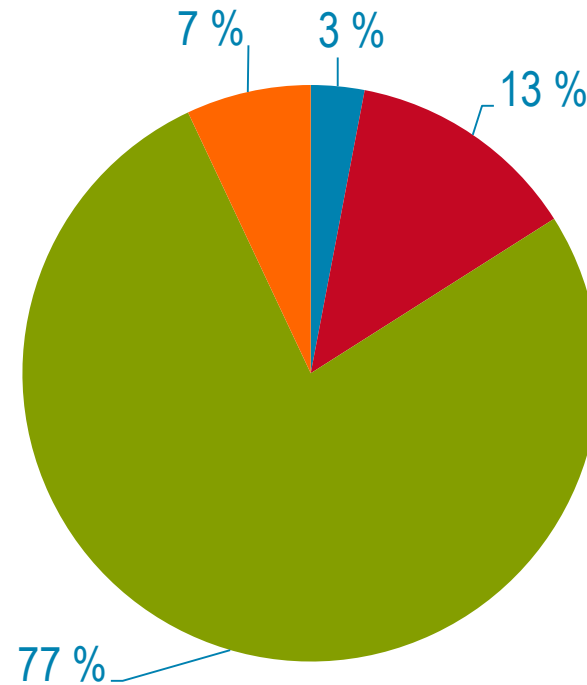


Fachverband
BIOGAS

% by weight



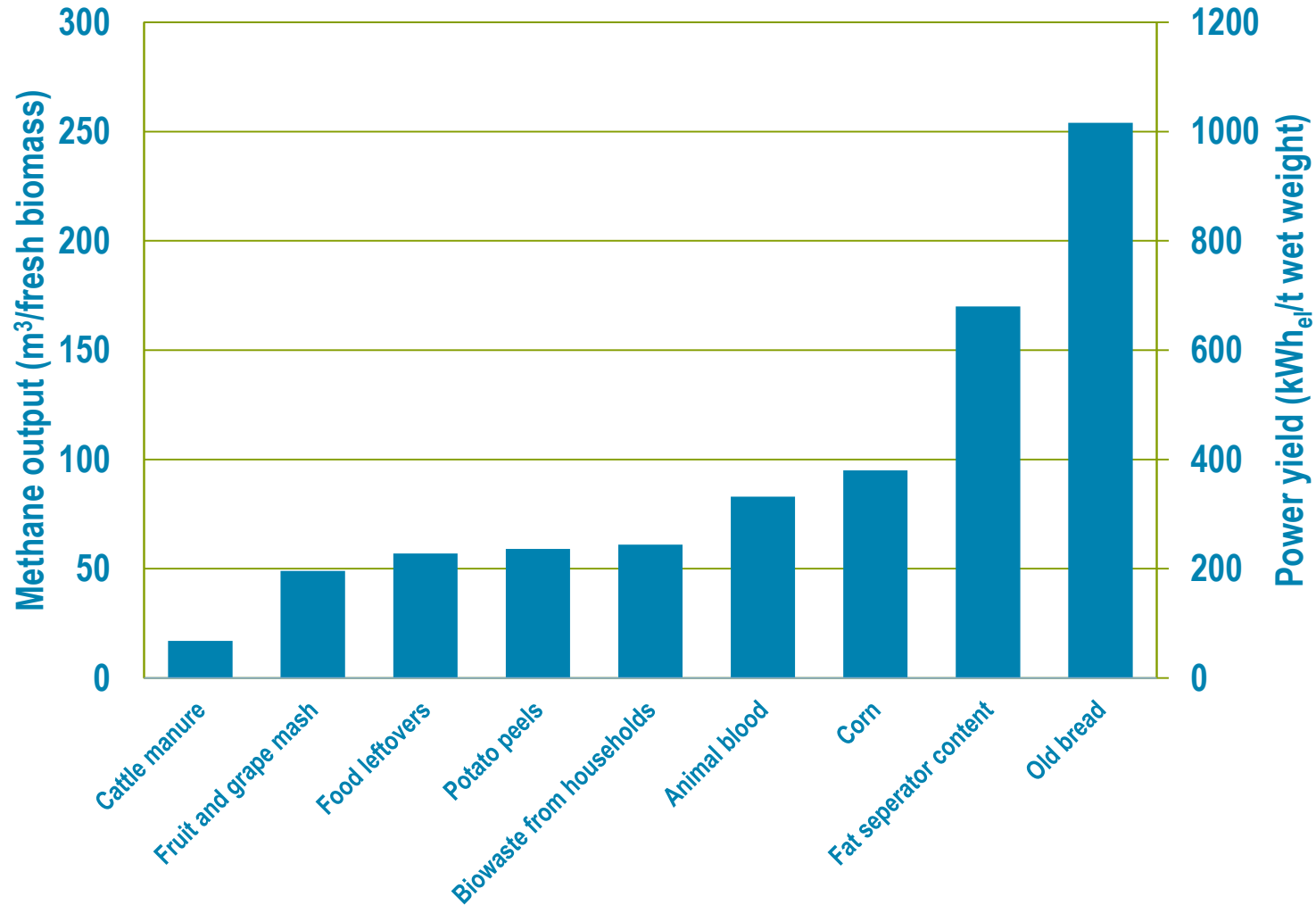
% by energy output



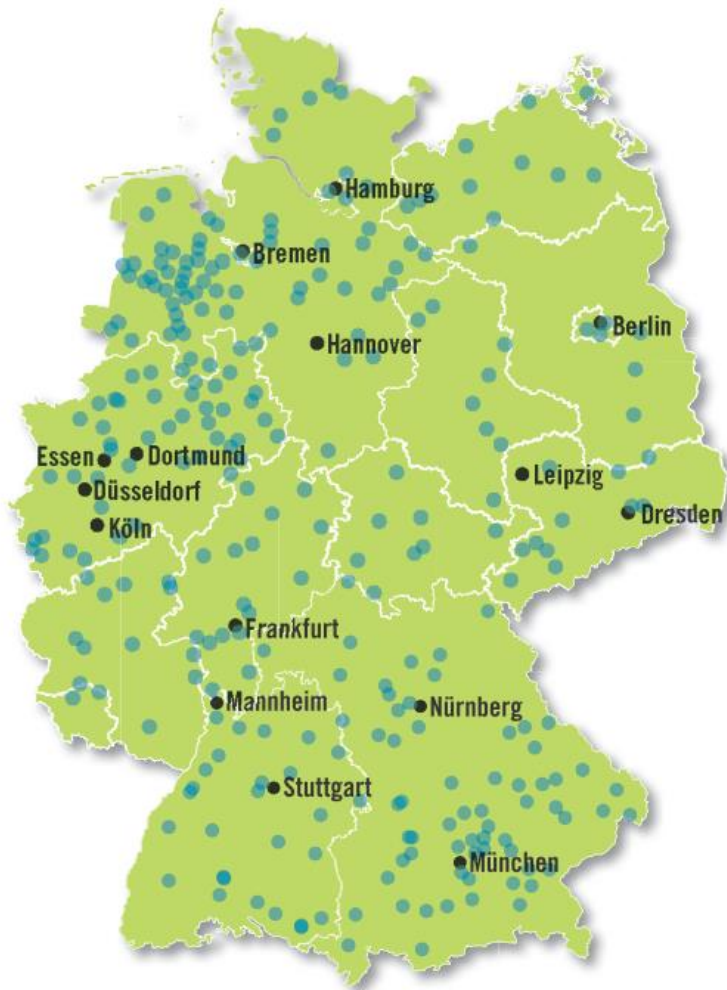
■ Biowaste ■ Liquid & solid manure ■ Energy crops ■ Industrial and agricultural residues

Source: Motoringbericht DBFZ, June 2014

Energy yield of possible feedstock



Waste digestion plants in Germany



- About 400 plants for the digestion of biological wastes and residues

- Feedstock categories:



Biowaste from households



Industrial and commercial wastes



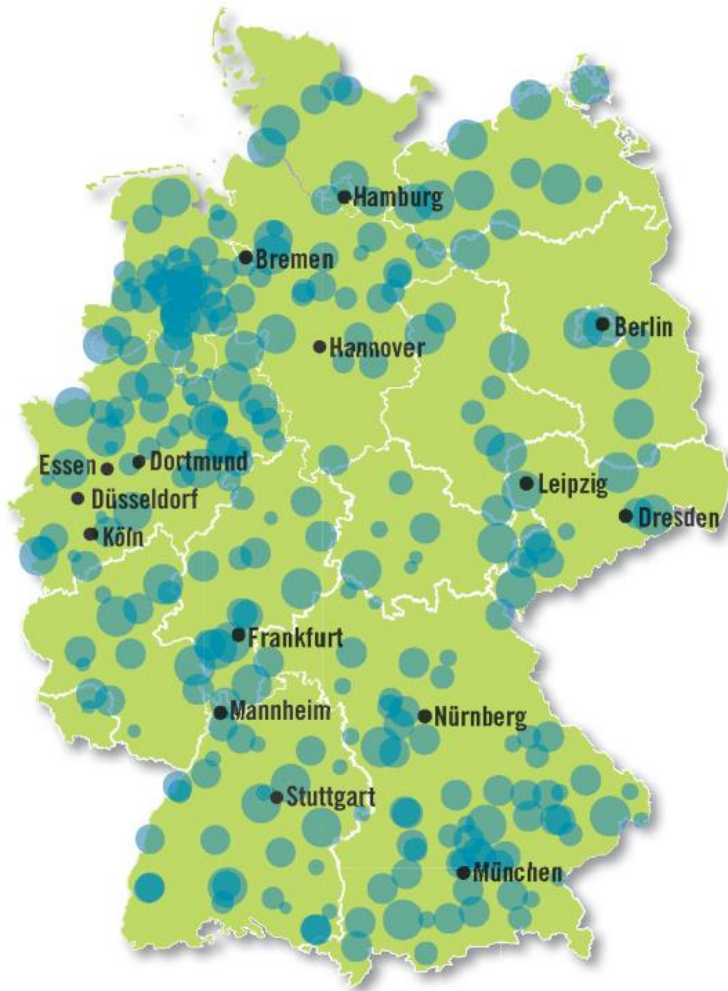
Animal by-products



Vegetable by-products

- Approved capacity ~ 8,9 Mio. Mg/a
- Installed electrical capacity ~ 266 MW

Approved capacity of German biogas plants



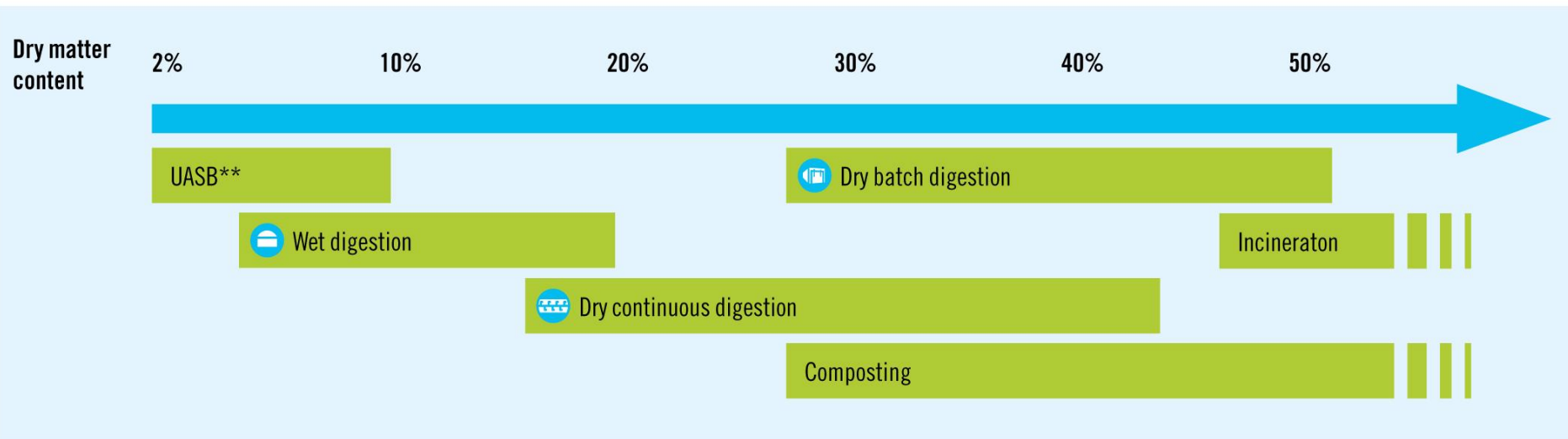
- Varying approved capacities between 510 and 500.000 tonnes (or Mg) per year
- Approved capacity in areas with less biogas plants (Eastern Germany) markedly higher than in areas with a higher plant density
- Average installed capacity: 975 kW

Approved capacity in Mg/a

> 510 ●●●●● 500.000

Used technologies for the anaerobic digestion of waste

Overview of technologies depending on dry matter content for the possible operating mode*

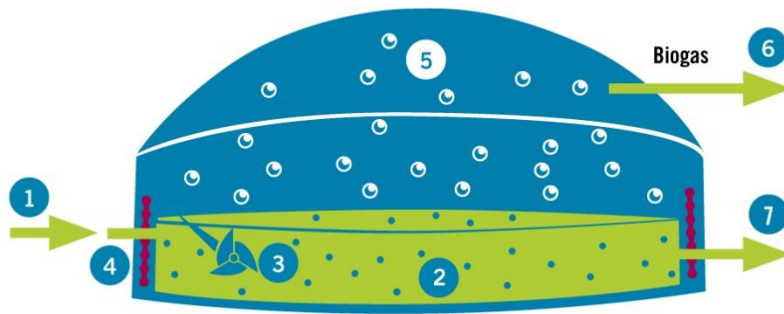


* Mostly every feedstock can be diluted to the needed dry matter content of each digester technology.

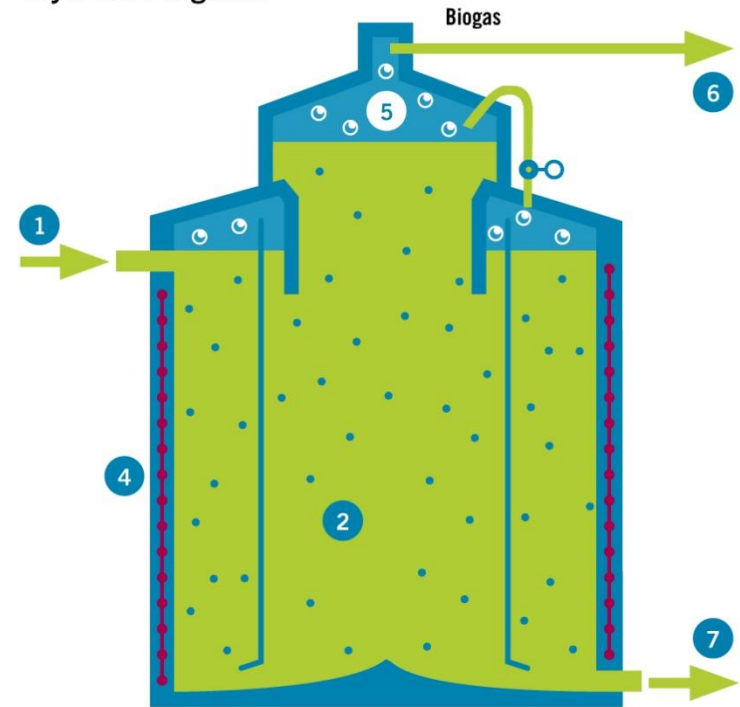
** UASB: Upflow anaerobic sludge blanket technology is a form of anaerobic digestion designed for materials with high water content (e.g. sewage sludge). UASB reactors are installed for waste or process water treatment.

Wet digestion

Continuously stirred tank reactor (CSTR)



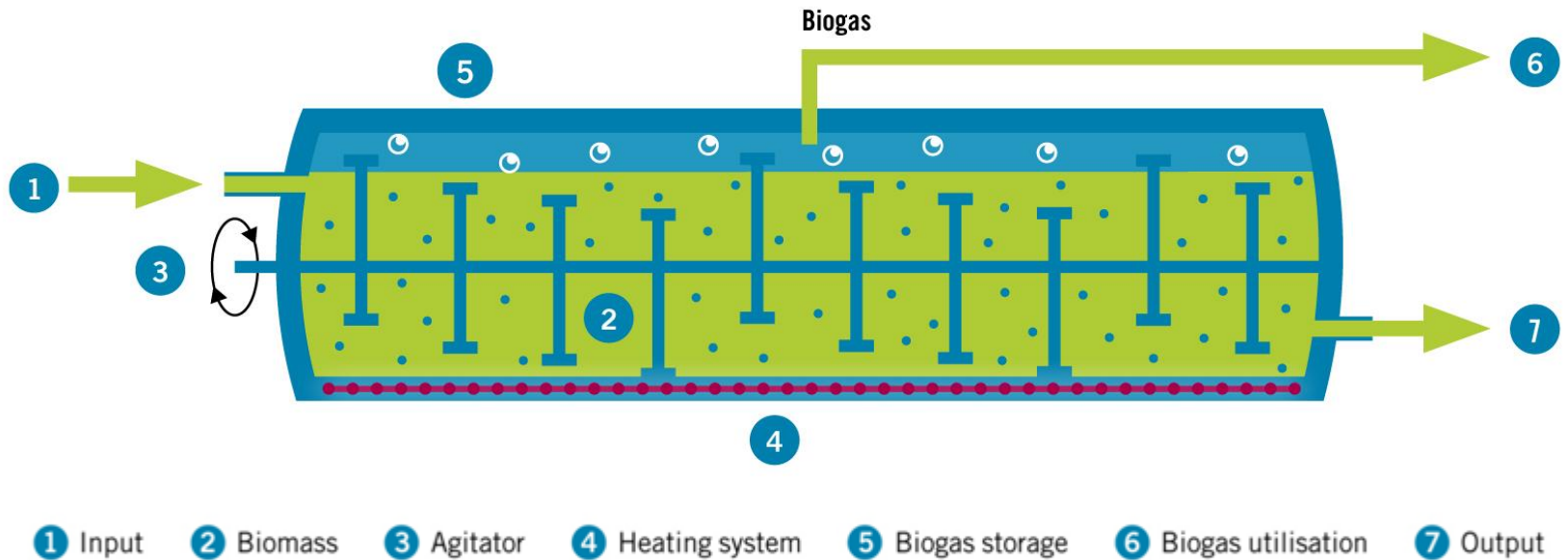
Hydraulic digester



- 1 Input
- 2 Biomass
- 3 Agitator
- 4 Heating system
- 5 Biogas storage
- 6 Biogas utilisation
- 7 Output

Dry continuous digestion

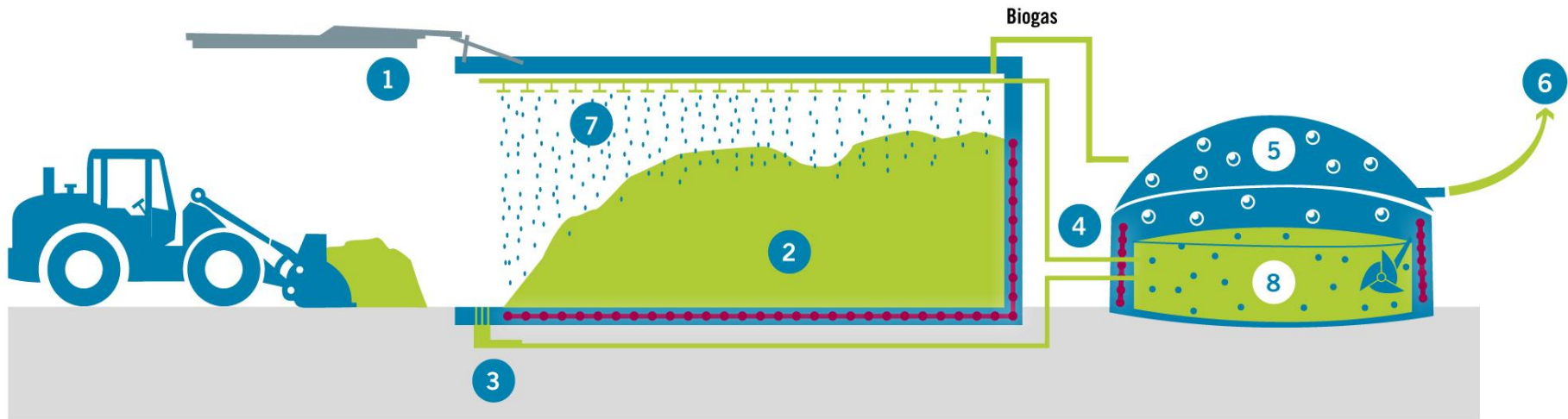
Plug flow reactor



Dry batch digestion

- 1 Gastight door
- 2 Biomass
- 3 Drainage system for percolation liquid
- 4 Heating system
- 5 Biogas storage
- 6 Biogas utilisation
- 7 Percolation liquid distribution
- 8 Percolation liquid storage tank

Garage systems



Closing nutrient cycles with organic fertiliser

- Application of digestate
 - depending on nutrient content
 - depending on nutrient demand of the crop
 - depending on region and soil
- Application rate approx. 10 - 40 m³ liquid digestate / ha
- Best harvest with combination with anorganic fertiliser
- Additional revenue potentials for plant operators



Upgrading of the digestate

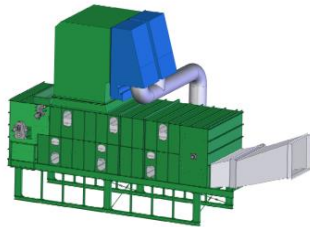
Separation



Separated
digestate



Drying



Dried digestate



Pelletising



Pelletised
digestate



Composting



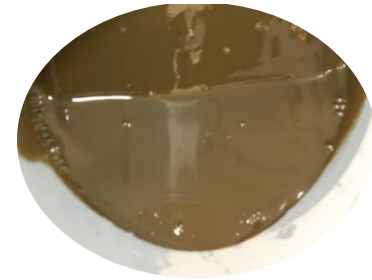
Composted
digestate



Liquid Upgrading



Liquid digestate



Source: Data of the RAL-quality assurance (2012)

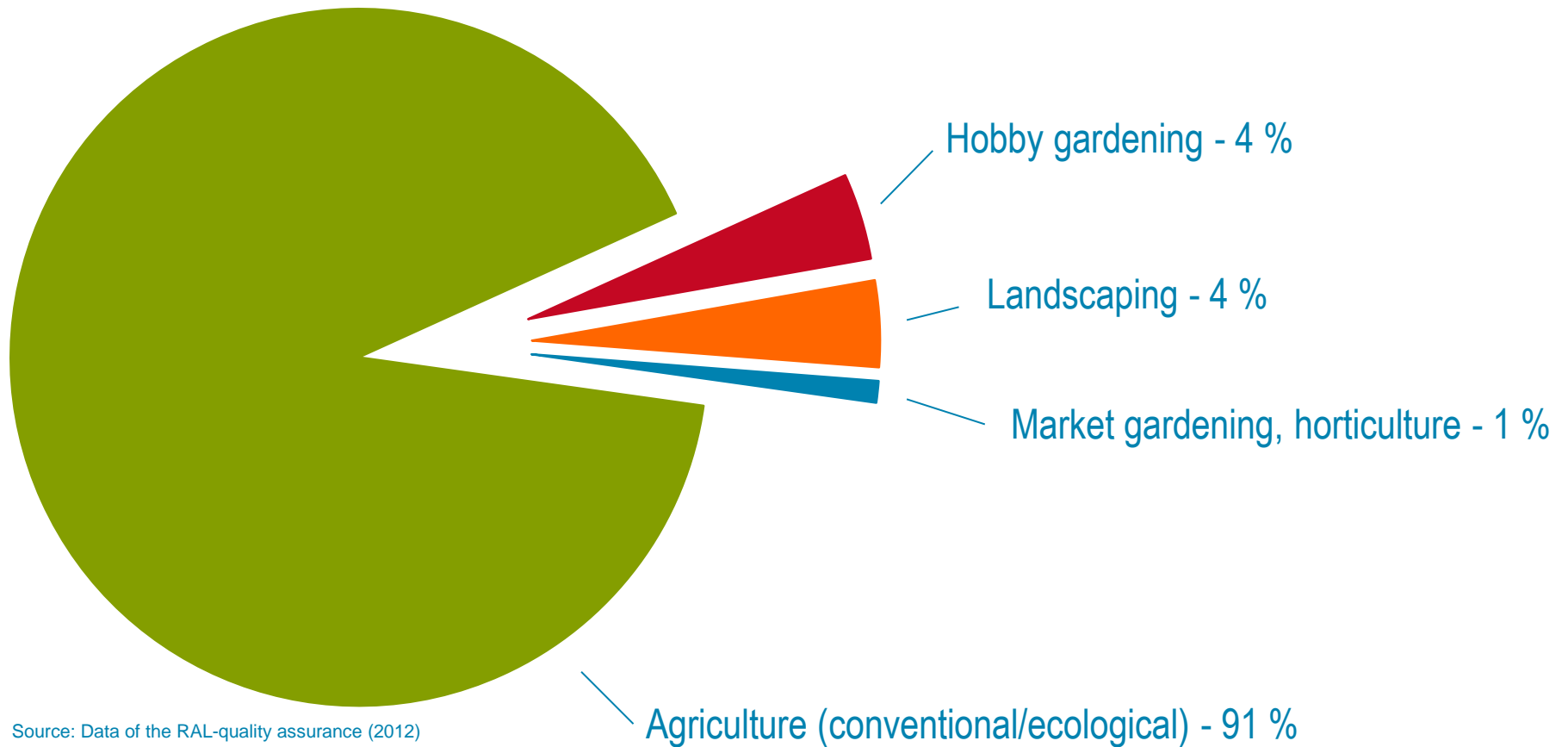
Clean waste streams



Contaminated waste streams

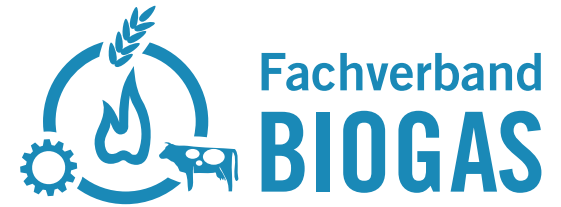


Current marketing of upgraded digestate



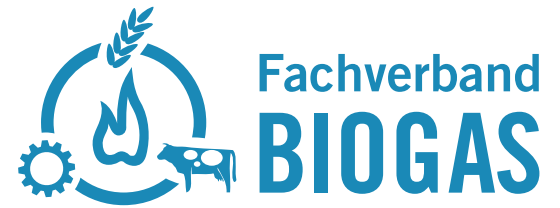
Source: Data of the RAL-quality assurance (2012)

Conclusion



- Various technologies are available for the digestion of waste and residues
- Nearly 400 of this plants are operated in Germany and 8,9 Million Mg residues can be utilised in an environmentally friendly manner each year
- The digestion of waste is a cascade utilisation as the energetic potential of the feedstock is not wasted
- The production of organic fertilisers can be an additional revenue for biogas plant operators
- Especially the marked segment of private consumers contains a huge potential

For more information....



giz

[...www.biowaste-to-biogas.com](http://www.biowaste-to-biogas.com)



Thank you for your attention!

