



Fermentation of waste and organic substrates from agriculture – technical possibilities and potential for the production of regenerative energy

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- 2. Fermentation plants for organic substrates**
- 3. Practical experience**
- 4. Summary**

Types of organic waste and other substrate for biogasplants





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Types of organic waste and other substrate for biogasplants

www.IEKrW.de

<http://www.biware.hs-bremen.de/>

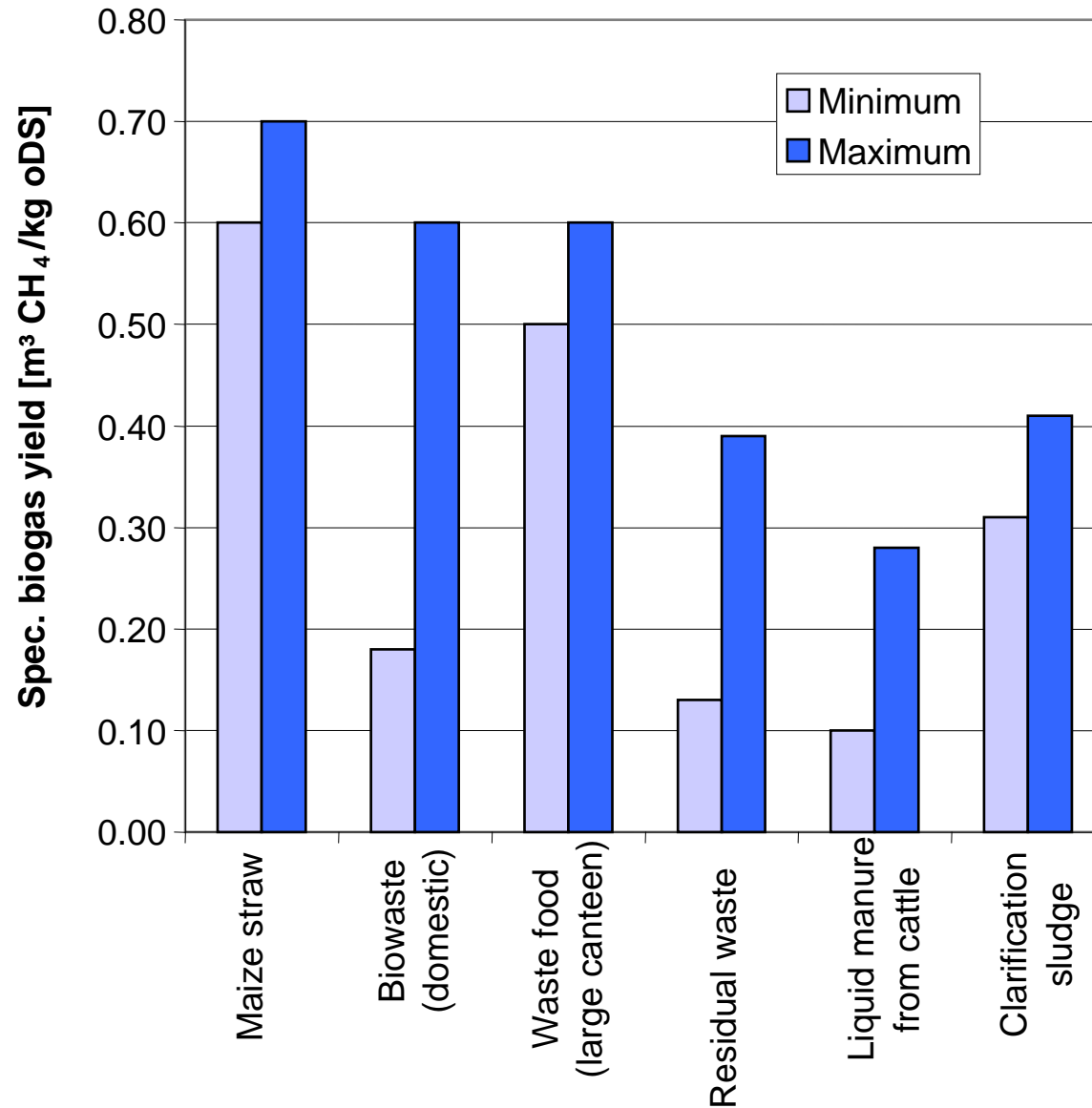
<http://www.renew.hs-bremen.de/>

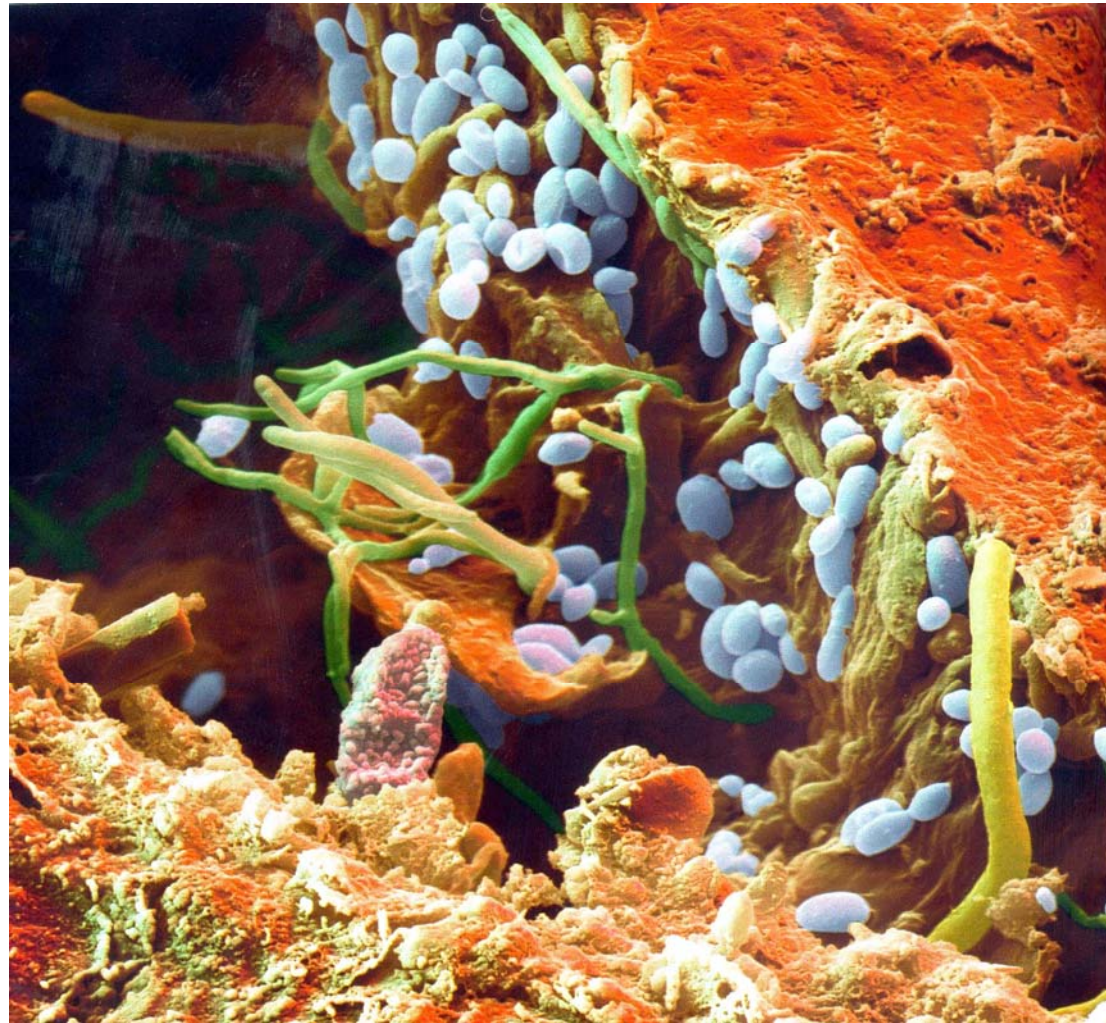
Substrates (municipal and industrial waste)	Suitability	
	Biogas process	Biomass combustion
Animal cadaver meal	+	+
Bagasse	-	+
Biowaste	+	+
Cereal mash	+	-
Clippings (sedge)	+	
Coco bean shells	-	+
Fat (from fat separators)	+	-
Filtration silica gel (beer)	+	-
Float fat	+	-
Flotation sludge	+	(+)
Foliage / leaves	+	(+)
Food waste	+	+
Fruit pulp (fresh)	+	-
Kitchen waste	+	+
Loppings	+	-
Market waste	+	+
Mash of apples	+	-
Mash of fruits	+	-
Molasse	+	-
Molasses mash	+	-
Oil seed residue (pressed)	+	(+)
Peanut husk	-	+
Pomace of apples	+	-
Pomace of fruits	+	-
Pomace of grape	+	-
Potato mash	+	-
Potato peel waste, raw	+	-
Potato pulp	+	-
Potato slop	+	-
Raps extraction residue	+	(+)
Rumen content (pressed)	+	-
Rumen content (untreated)	+	-
Sewage sludge	+	(+)
Slaughterhouse waste	+	(+)
Spent grains from beer	+	(+)
Spent hops (dried)	+	+
Stomache contents (pig)	+	-
Straw	(+)	+
Vegetable waste	+	+
Vinasse	+	-
Whey	+	-
Yard trimming	+	-

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Hereby means: “+”: suitable, “-”: not suitable, “(+)”: limited suitability

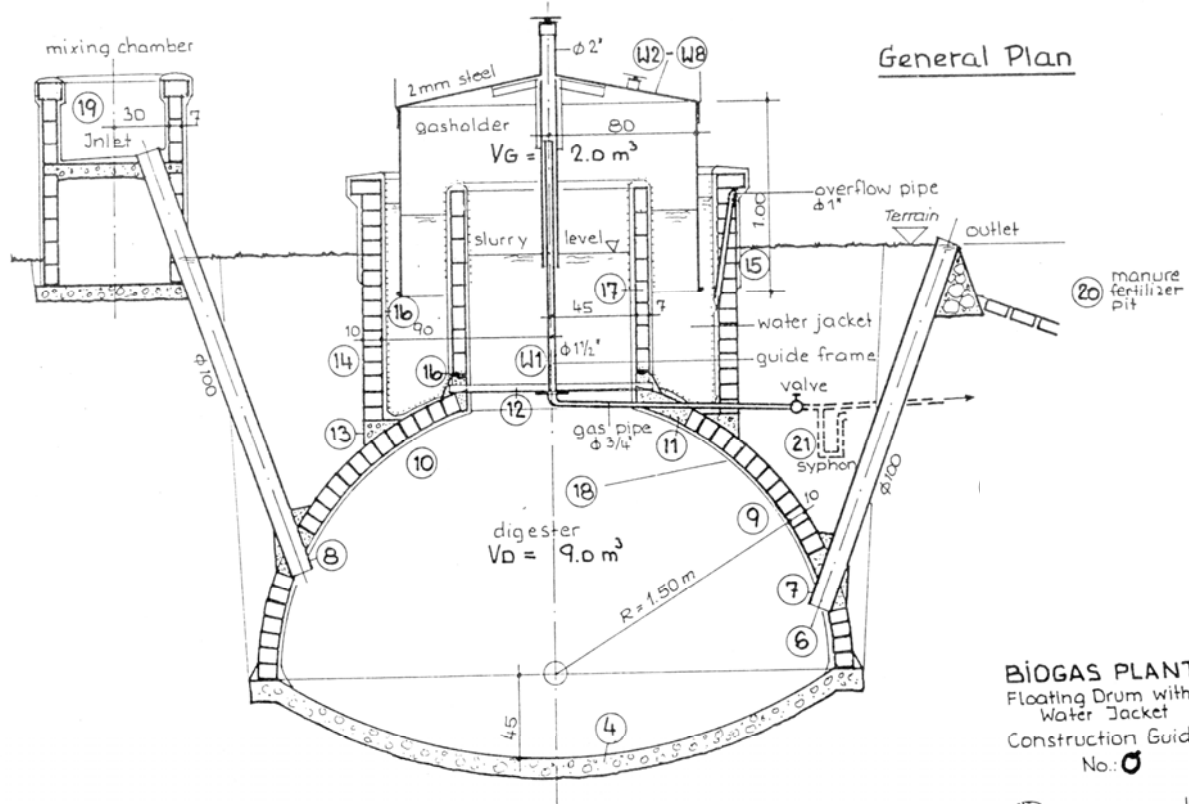
Biogas yield from organic waste







Simple bio-gas plant for production of cooking gas for a single household



BIOGAS PLANT
Floating Drum with
Water Jacket
Construction Guide
No.: 6

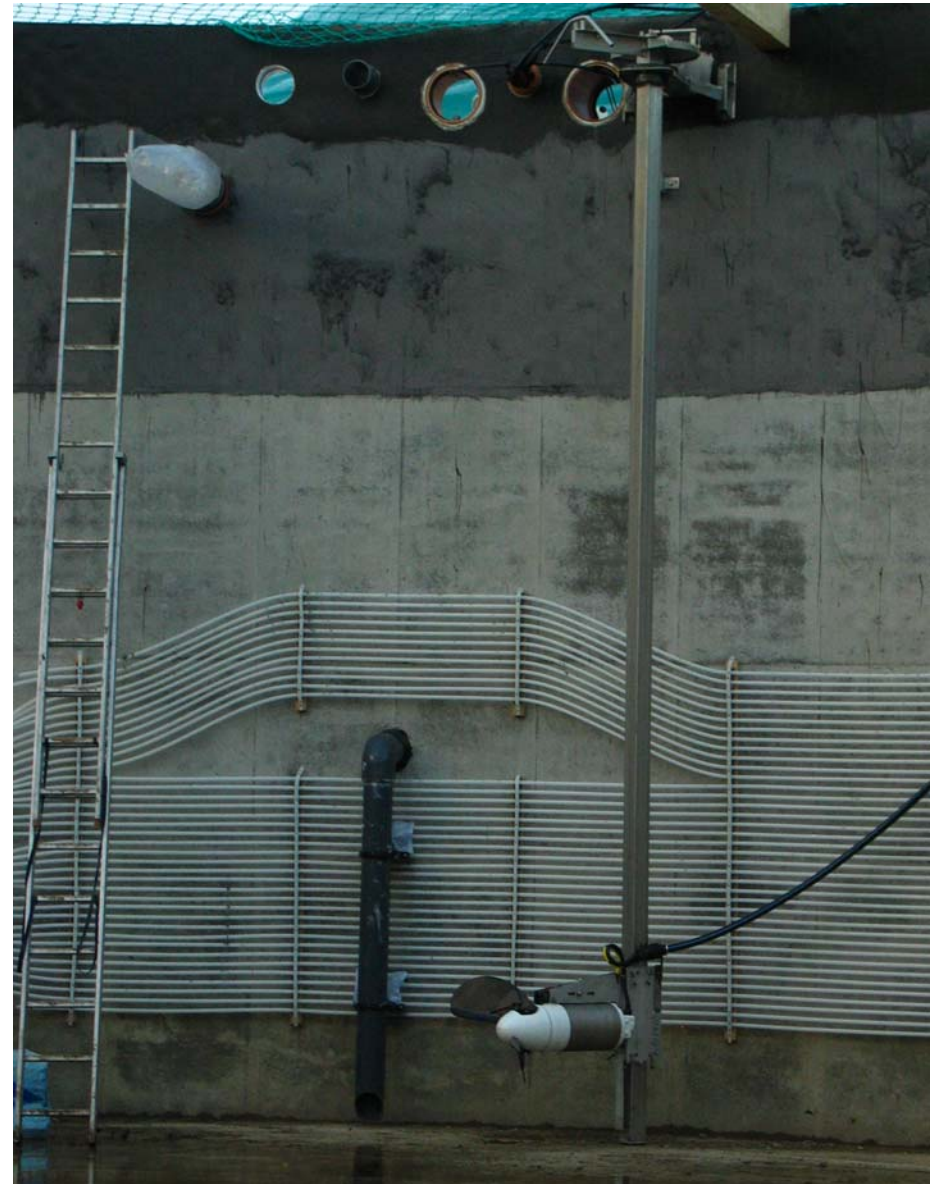




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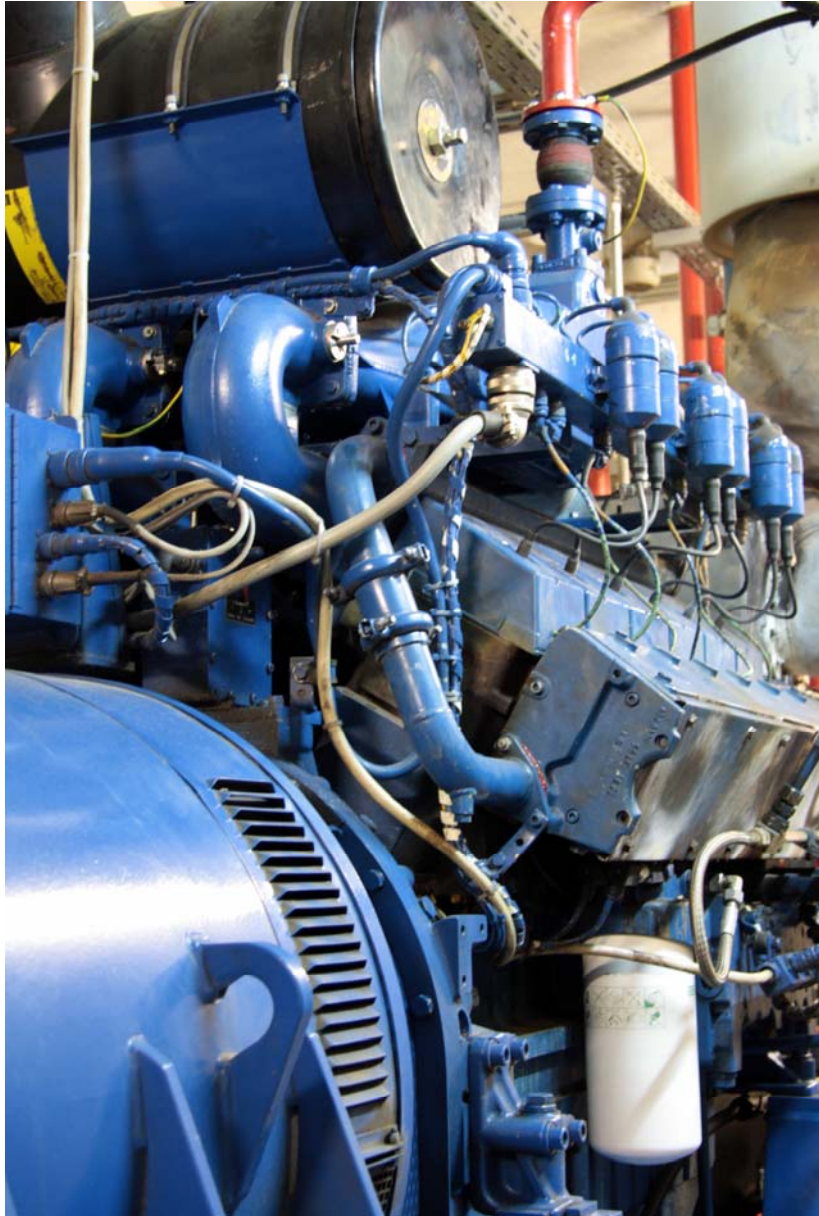
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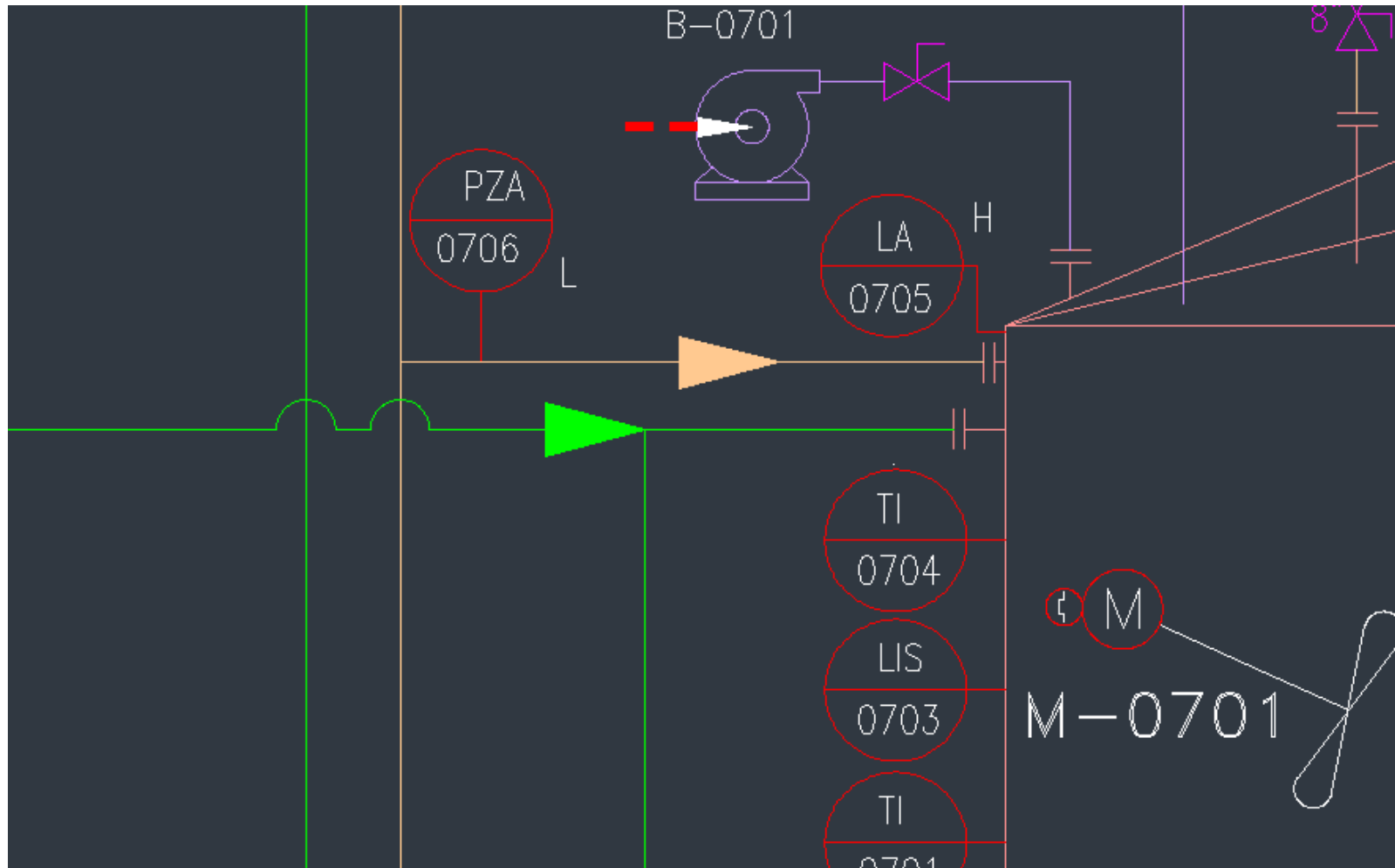




Agricultural biogas plants

Source: Biogas Weser-Ems GmbH







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Biogas plant, Radeberg

- **Co-fermentation of clarification sludge and biowaste**

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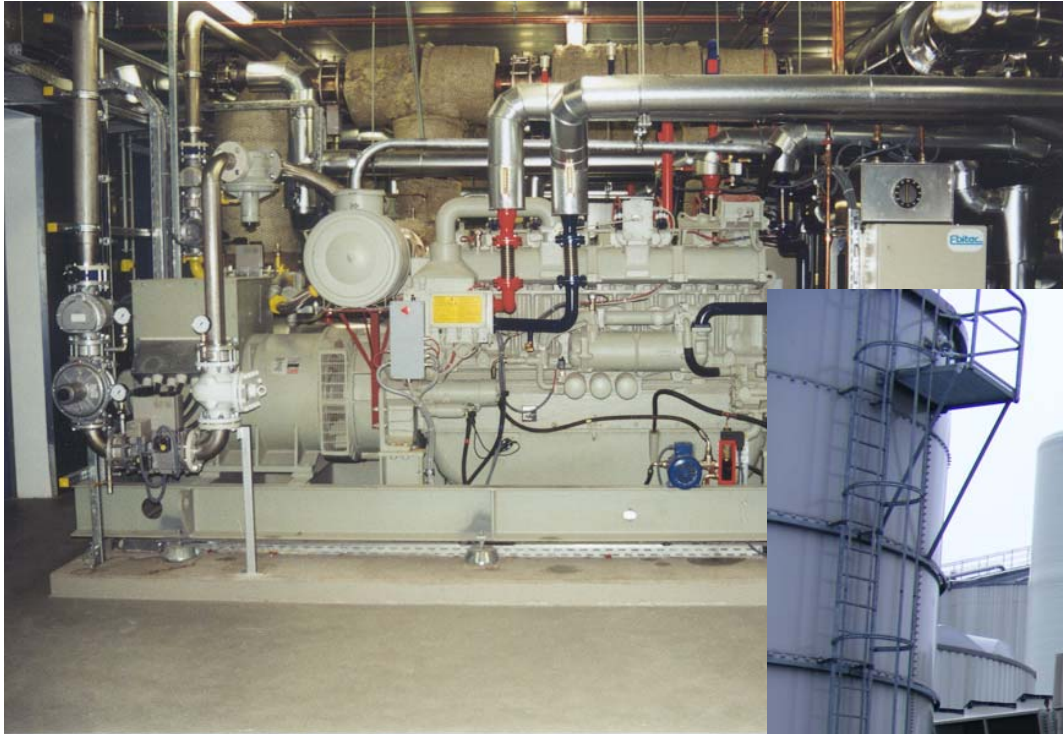


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Exemple: Dry fermentation, percolation process (BEKON)

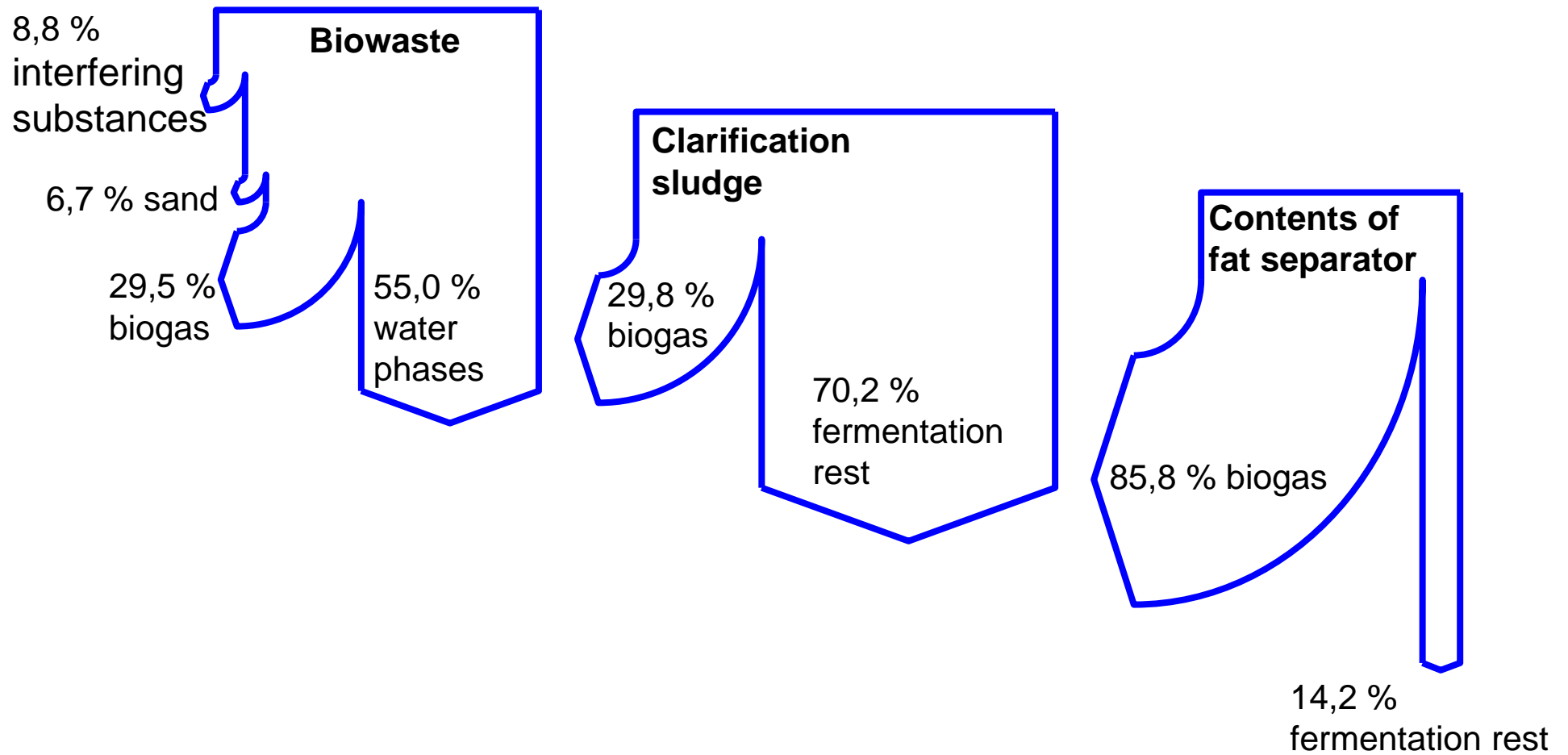
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- batch-process
- inoculation with substrate from the batch-fermentation before
- without pre-crushing
- without separation of interfering substances
- without biogas-storage

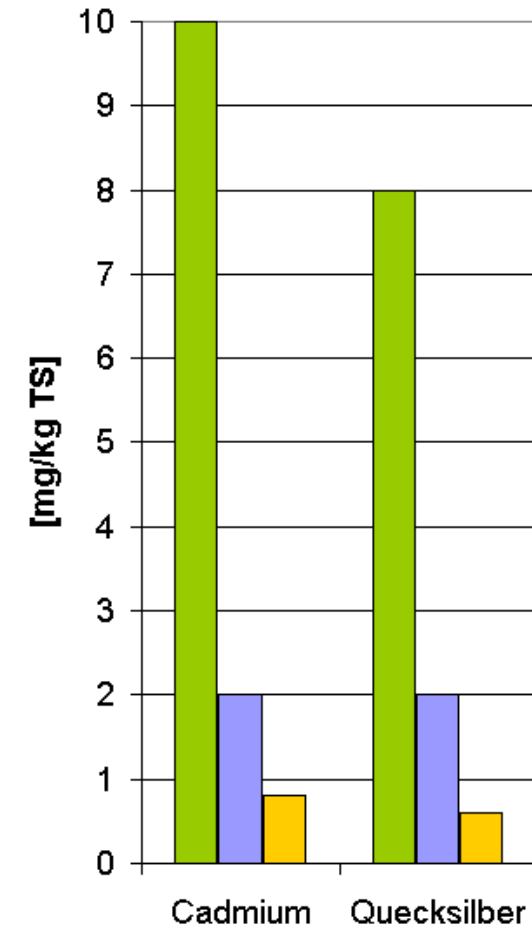
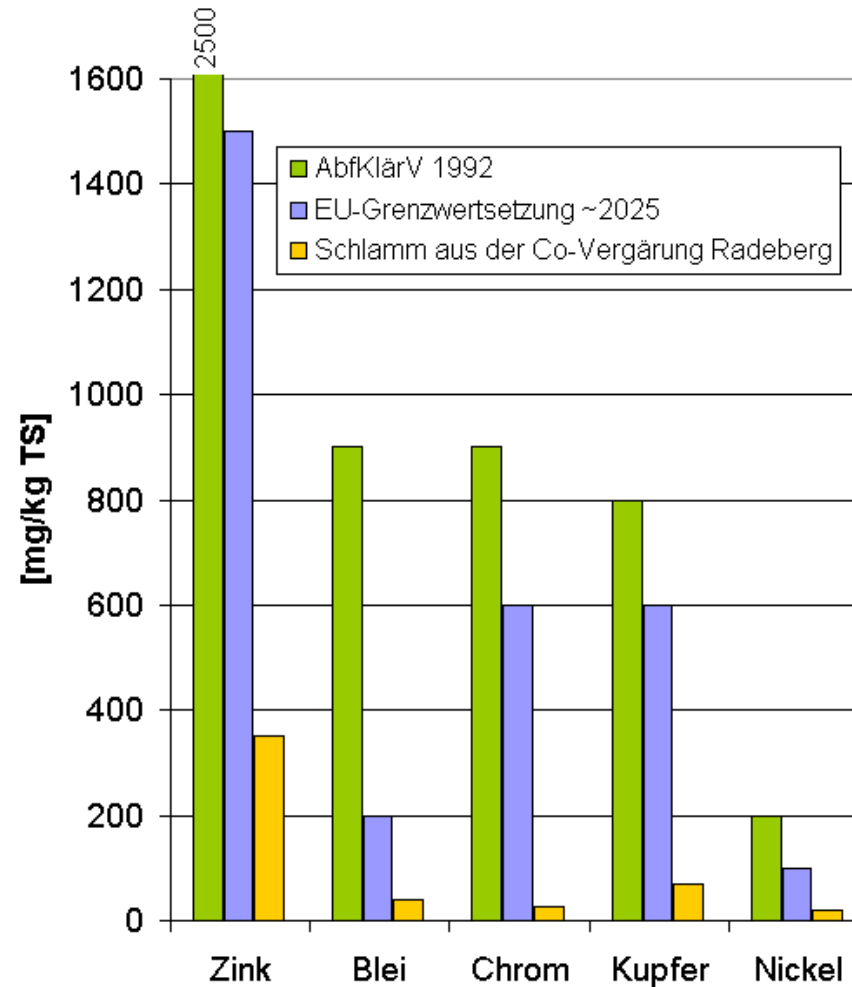
- ..., simple process



Material flow analysis, with regard to the dry substance



Comparison of limit values and target values for clarification sludge used in agriculture with mean heavy metal content in fermentation sludge of the Radeberg co-fermentation plant





Old power station and environmental risk of using fossil fuel for electricity generation

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Summary

- There is a wide range of organic substrates with a high biogas potential.
- Plant designs are available for the most diverse applications (from individual homes to large-scale industry).
- A sustainable infrastructure for organic waste management can be put in place with biogas plants
- Decentralised plants have a positive effect on regional development (jobs, fiscal revenues, decentralised electricity and thermal energy production).
- Primary energy sources (fossil fuels) are replaced by renewables, thus combating global warming and conserving non-renewable resources.
- High quality fertiliser is produced from secondary raw materials, which substitutes for mineral fertiliser (e.g. phosphate). They:
 - are sanitised, contain no germinating plant seeds and are free of pathogens (tobacco mosaic virus, Salmonella ...)
 - have a low pollutant content (depending on the materials used)
 - are well tolerated by plants, form humus, and help to prevent soil erosion.