UTS Biogastechnik GmbH

Maximizing Biogas Production
Technical and Biological Challenges

European Biomethane Fuel Conference,
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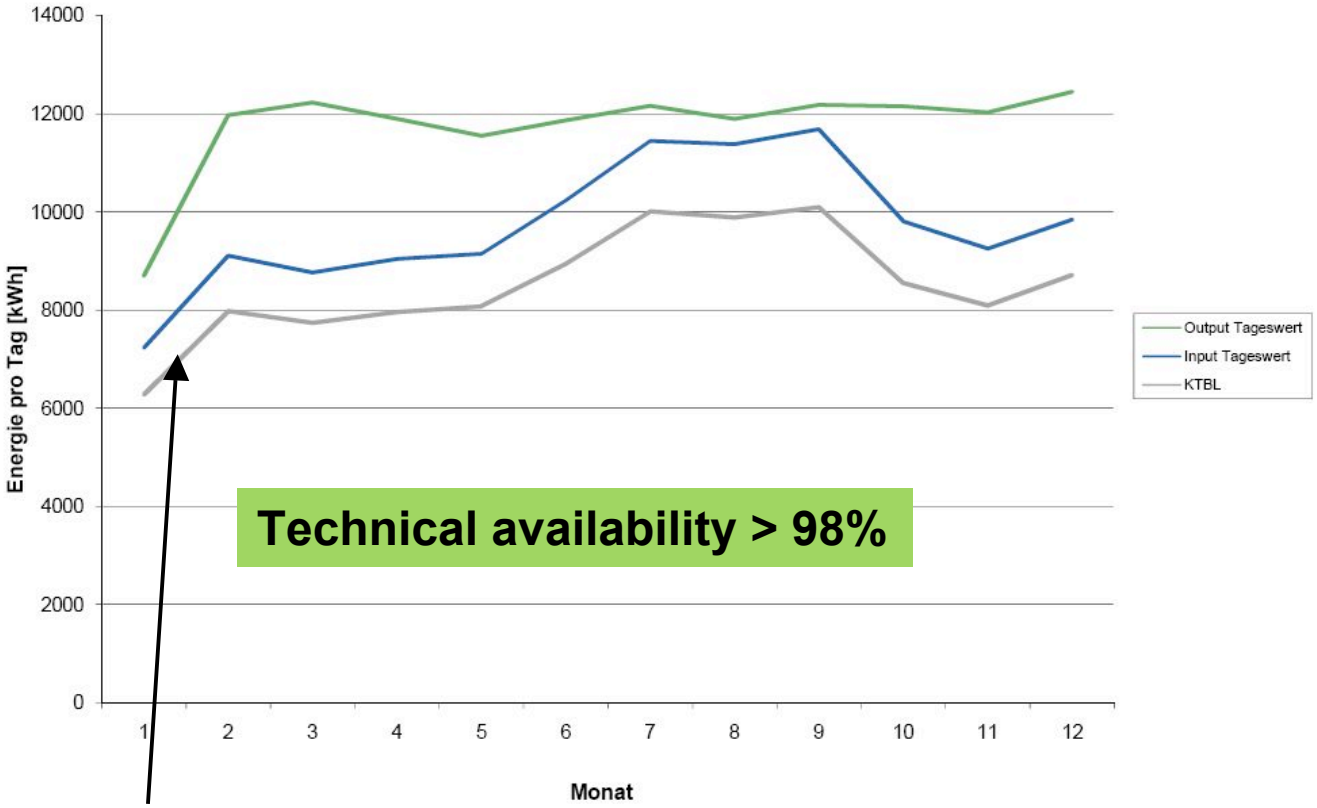
Reliable Biogas Technology.

Goals:

- Producing the maximum output of biogas/biomethane
  based upon
  - available substrates
  - limitation of energetic use
  - economic sense
- Reliable and stable production of biogas/biomethane

Example:



Commissioning phase! 526 kW el installed

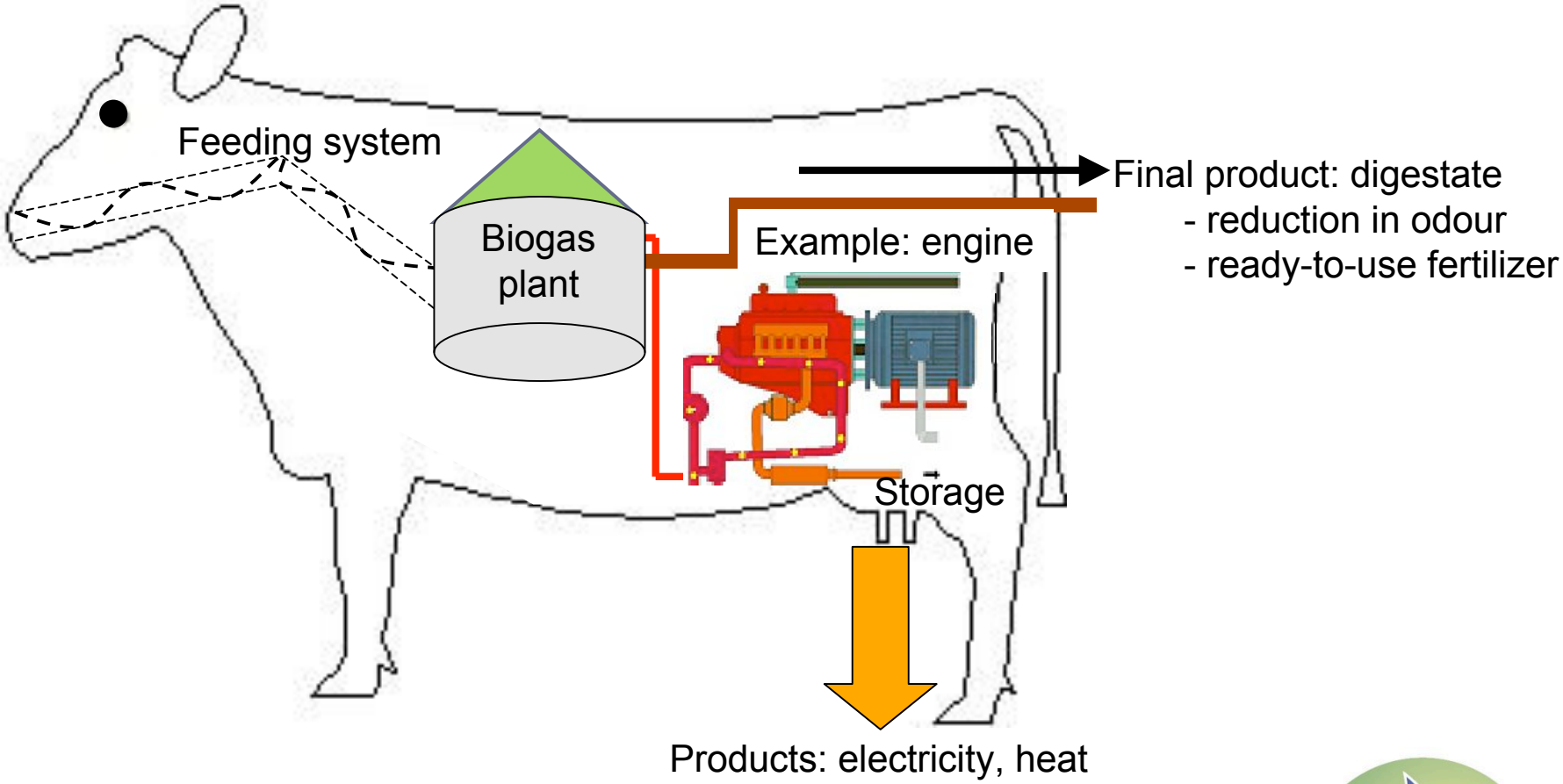
Presentation Content

1. Some Biogas Basics
2. Input / Substrates
3. Biological Process
4. Technical Issues
5. UTS Company Information

Topic 1: Some Biogas Basics

- Regulations / economic driver(s)
- Substrates
- Size of plant
- Energetic use of biogas

Conventional “Biogas Plant“

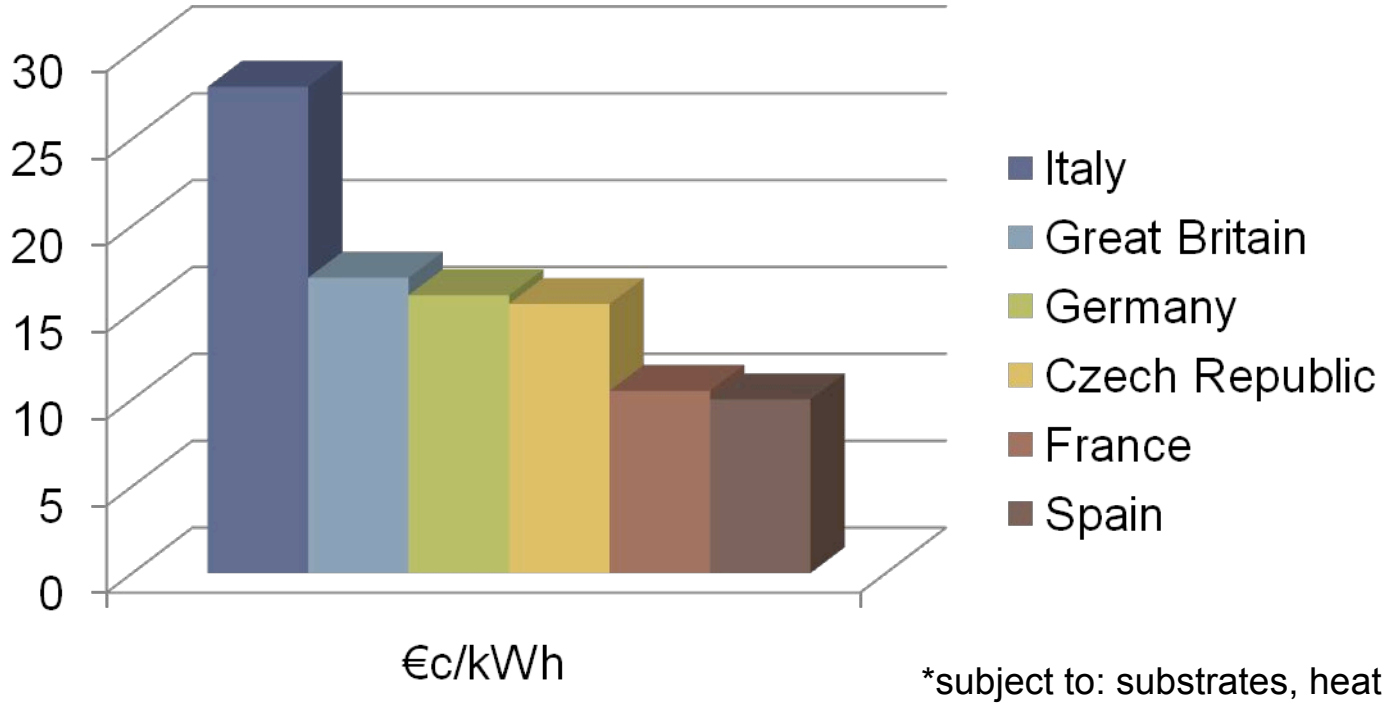


Regulations / Economic Drivers

- Energy (electricity, heat, biogas, biomethane)
- Funds/grants
- Tip fees for waste streams / reduction of waste
- Reduction of smell
- CO_2 certificates
- Production of “bio fertilizer“

Regulations / Economic Drivers

- Approx. sales price per kWh el for ~ 1 MW el (~ 440 m³/h of biogas @ 53% CH_4)*



*subject to: substrates, heat concept, technology etc.

Consequences

- **Applied technologies = f (economic drivers)**
- E.g.
  - choices of substrates
  - sophistication of feeding system
  - hydraulic retention time
  - choices of energetic use
  - post-treatment of digestate
- Every European country defines the role of biogas/biomethane separately and individually!

Topic 2: Input / Substrates

General choices:

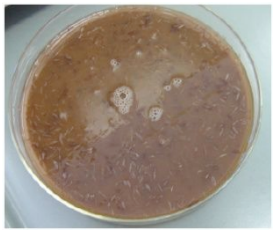
- Agricultural wastes, e.g. manure, slurry
- Agricultural products, i.e. “energy crops“
- Simple organic waste streams (no pre-treatment), e.g. whey, stillage
- Complex organic waste streams (pre-treatment), e.g. kitchen waste, slaughterhouse waste

Diffferent Feedstocks = Different Yields

Pig manure

Corn silage

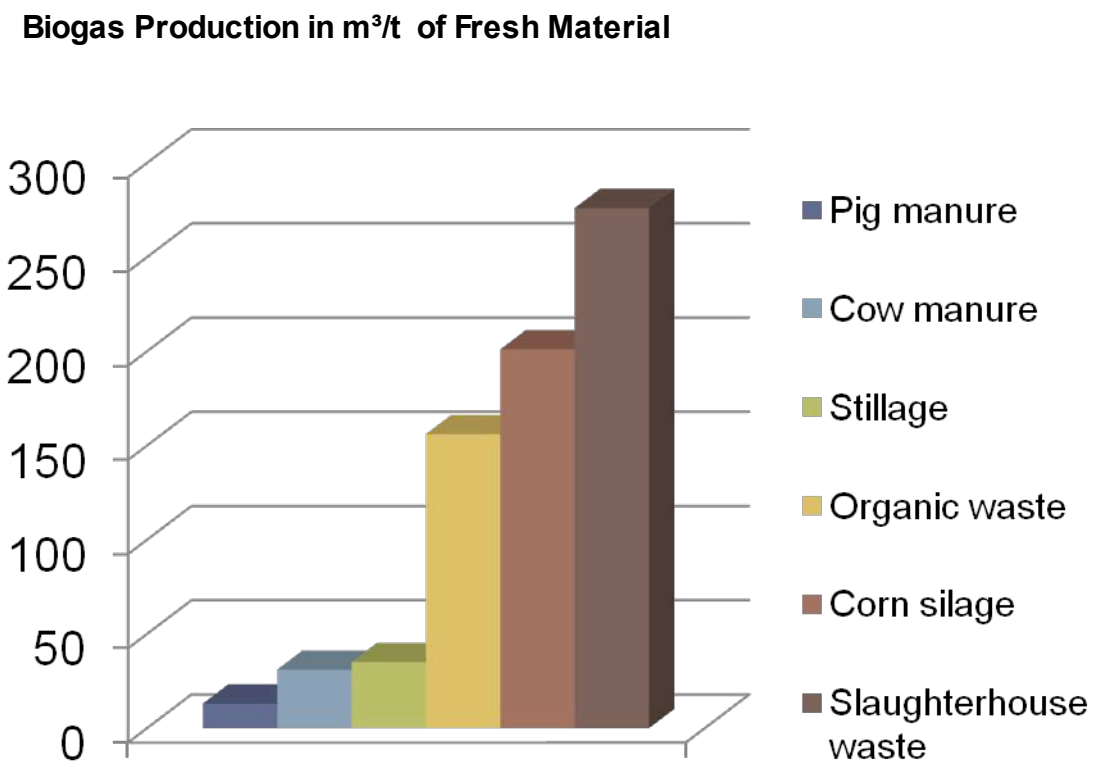
Cow manure



Stillage

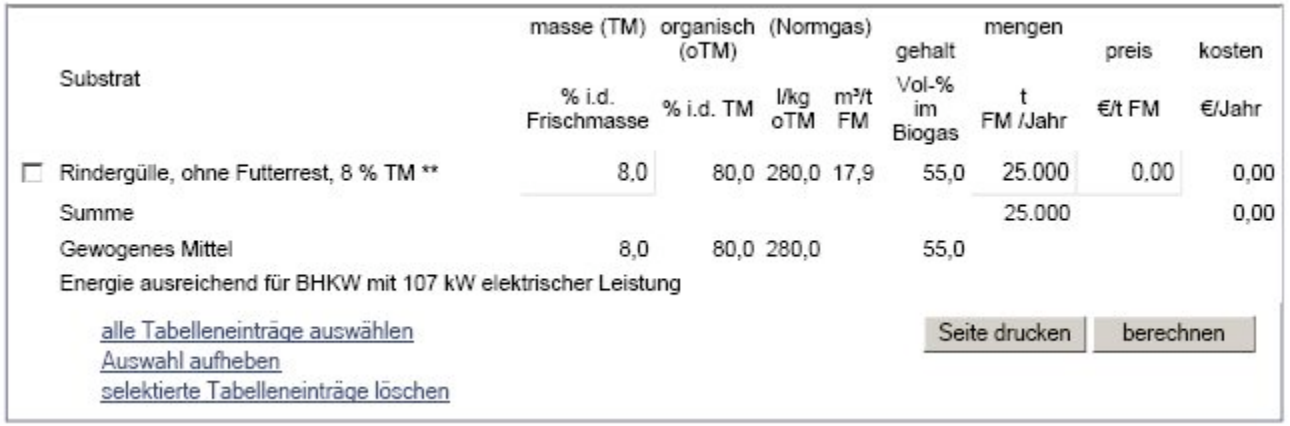
Slaughterhouse waste

Organic waste



How to arrive at the Input Value

- Measurement in laboratory
- Calculation
  - vendor-specific
  - neutral basis
- E.g. KTBL http://daten.ktbl.de/biogas/startseite.do#start



Substrat	masse (TM) % i.d. Frischmasse	organisch (oTM) % i.d. TM	(Normgas) l/kg oTM	(Normgas) m³/t FM	gehalt Vol-% im Biogas	mengen t FM /Jahr	preis €/t FM	kosten €/Jahr
Rindergülle, ohne Futterrest, 8 % TM **	8,0	80,0	280,0	17,9	55,0	25.000	0,00	0,00
Summe						25.000		0,00
Gewogenes Mittel	8,0	80,0	280,0		55,0			

Energie ausreichend für BHKW mit 107 kW elektrischer Leistung

alle Tabelleneinträge auswählen
Auswahl aufheben
selektierte Tabelleneinträge löschen

Seite drucken | berechnen

Suitability of Substrates

- Technology to feed, transport, mix, pump
- Flexibility is typically required
  (with impact on investment costs)

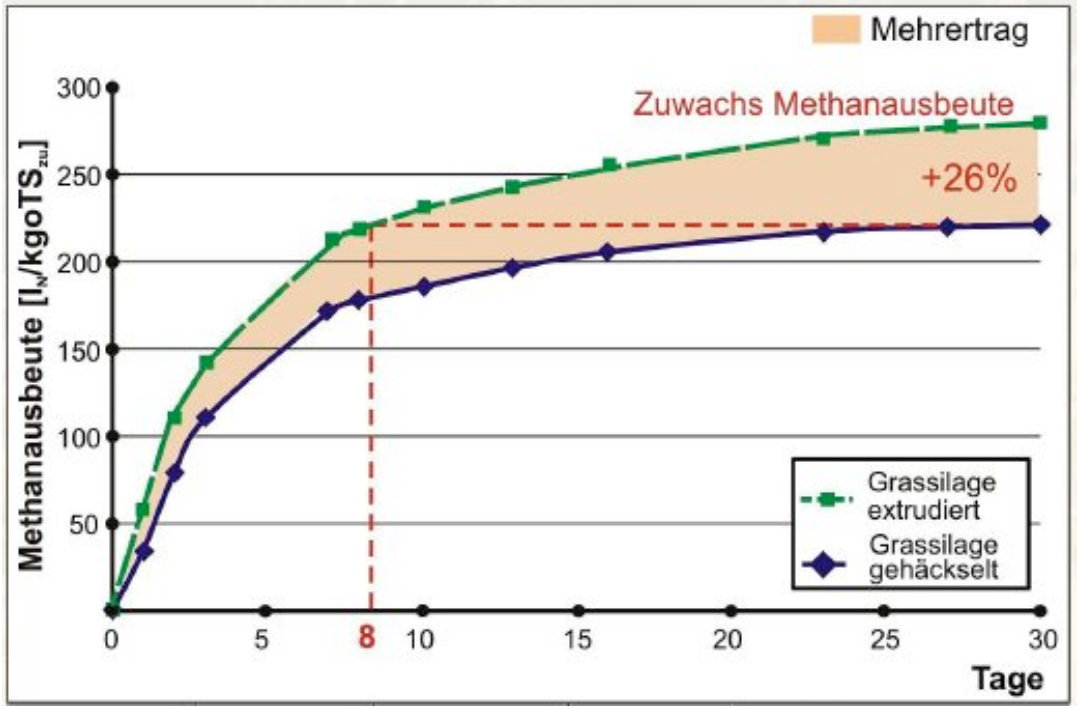
?

Quality/Pre-Treatment of Substrates

- Goal:
  make substrates (easily) digestable for microorganisms
- Means:
  - mechanical (cutting, extrusion, hammer mill)
  - chemical/biological (enzymes)
  - physical (temperature, ultrasonic)

Example of improved Digestion

Extrusion of grass silage



Extruder: thermo-mechanical pre-treatment
~ 10-15 kWh / t of fresh material
Values by Lehmann, www.lehmann-maschinenbau.de

Some Thoughts on Size

- Typical by size of gas engine size (e.g. 1 MW el) or of biogas purification system (e.g. 440 m³/h)
- This size equals 100% capacity
- Operating at >100% is not possible (or limited by storage capacity on site)
- Operating constantly at 100% is not advisable as fluctuations will lead to release/flaring off of excess biogas
- Typical operation goal: 90-95% of 100% capacity

Example of 1 MW el Plant Size (German Style)

SÖHNergy

UTS Biogastechnik GmbH

Inputs daily

~ 49 t/d energy crops

CHP

1 x 1021 kW

Electricity produced

Per day:	19 MWh
Per year:	6.800 MWh

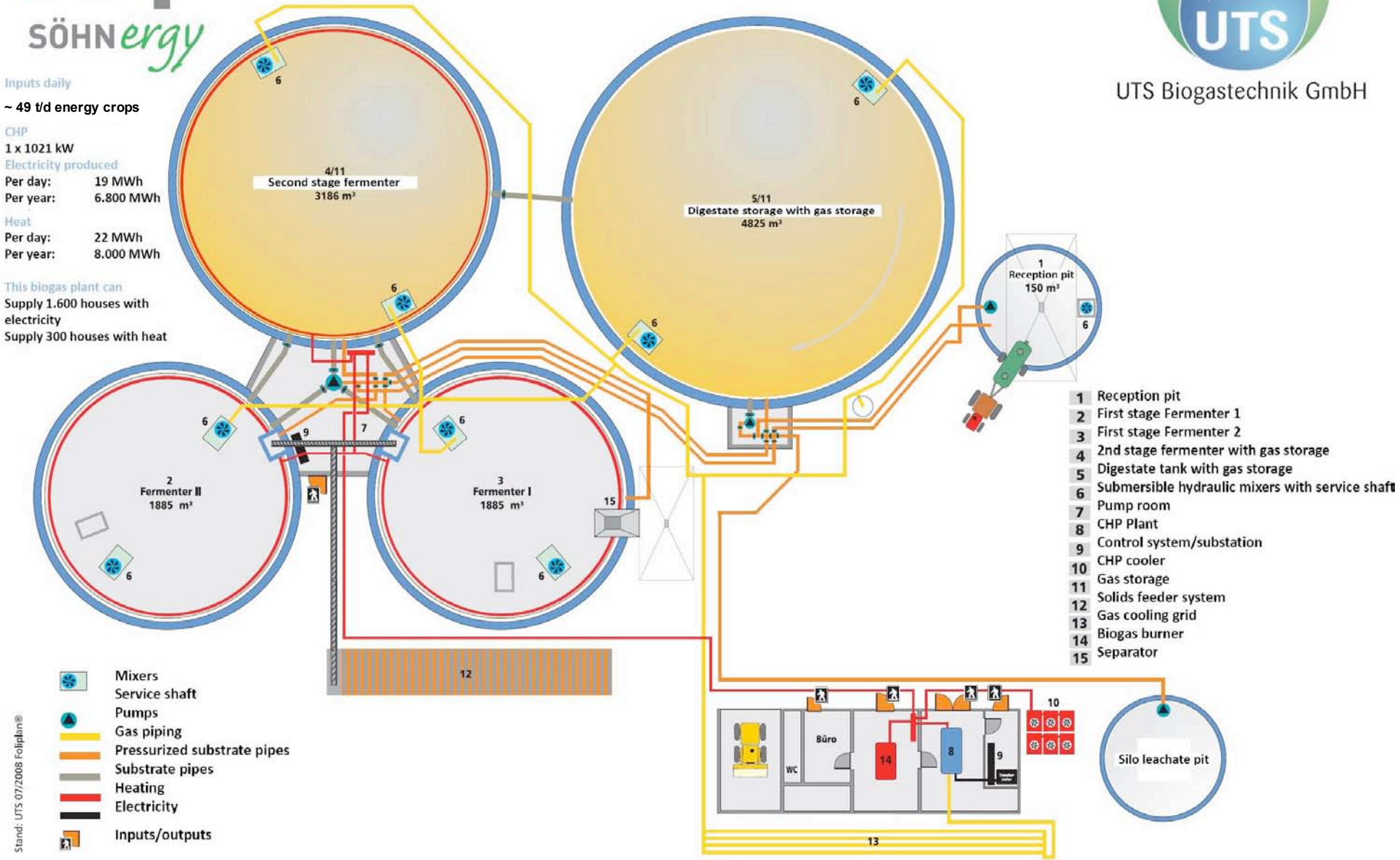
Heat

Per day:	22 MWh
Per year:	8.000 MWh

This biogas plant can

Supply 1.600 houses with electricity

Supply 300 houses with heat

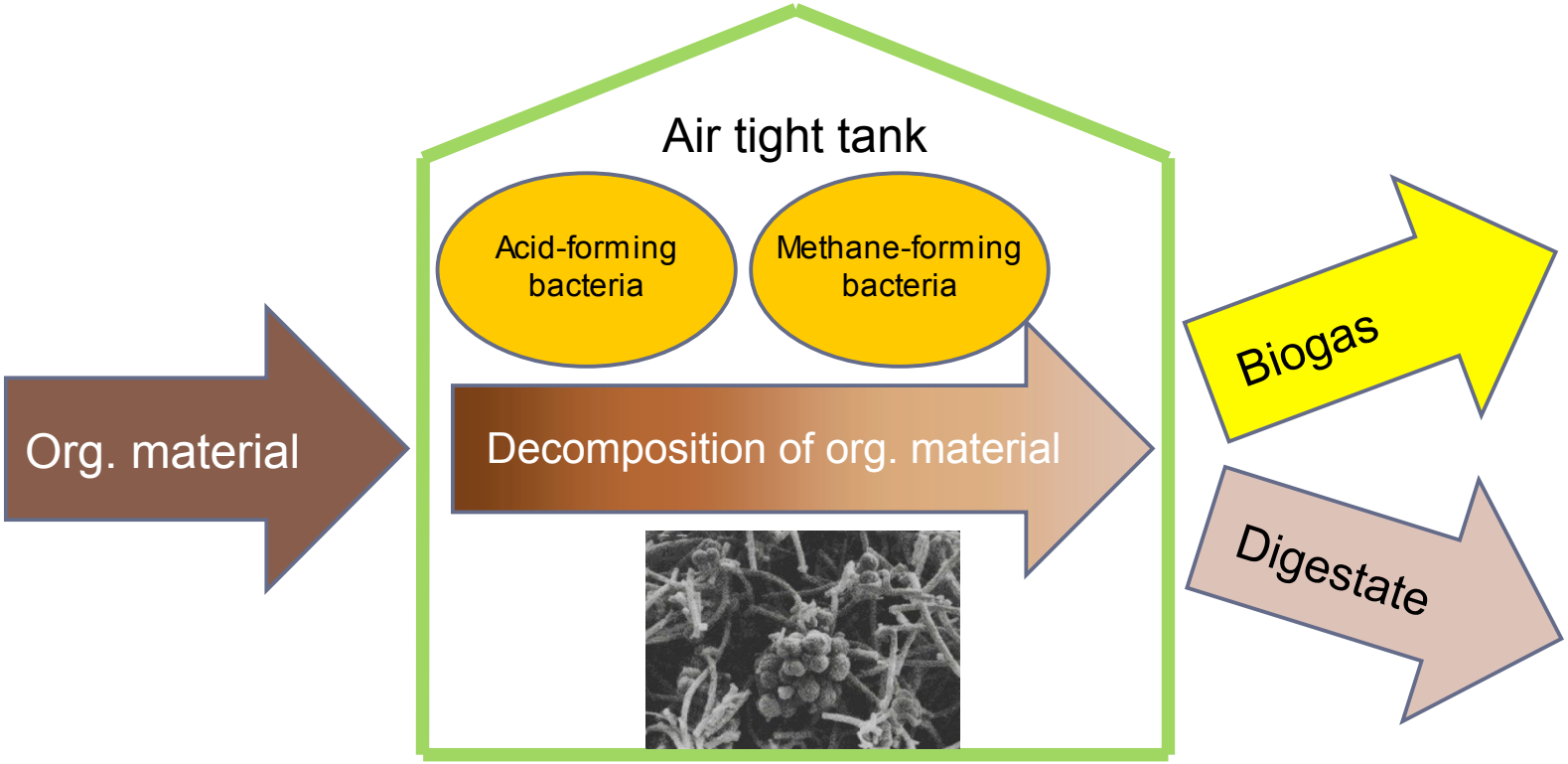


1 Reception pit
2 First stage Fermenter 1
3 First stage Fermenter 2
4 2nd stage fermenter with gas storage
5 Digestate tank with gas storage
6 Submersible hydraulic mixers with service shaft
7 Pump room
8 CHP Plant
9 Control system/substation
10 CHP cooler
11 Gas storage
12 Solids feeder system
13 Gas cooling grid
14 Biogas burner
15 Separator

Observations of German Style 1 MW el

- Input ~ 49 t/d of energy crops
- No manure, no liquids
- Total fermenter volume = ~ 7,000 m³
- 2-stage process with 2 parallel 1st fermenters
- Hydraulic retention time >> 100 days
- Covered digestate holding tank

Topic 3: Biological Process



Min. retention time ~ 10 – 60 days

Balance

- Acid-forming bacteria
  - pH value 4 – 5
  - T > 8°C
  - generation cylce 4 – 5 days

- Methane-forming bacteria
  - pH value 7.4 – 8
  - T ~ 35 – 45°C (mesophilic),
    ~ 52 – 55°C (thermophilic)
  - generation cycle 10 – 14 days

Macronutrients

- CNPS
- Target relationship 600:15:5:3
- Close C:N relation => can hinder biology
- Wide C:N relation => normally not an issue
- S (e.g. by rape seed) can hinder biology and can negatively impact gas quality

Micronutrients

Trace Elements	Range of Concentration [mg/l]
Fe	1 – 10
Ni	0.005 – 0.5
Ko	0.003 – 0.06
Mb	0.005 – 0.05

Inhibitors

- Presence of disinfectants/antibiotics
- Ammonium NH_4-N > 3 kg/m³ substrate
- Ammonia
  NH_3-N > 0.015 mg/l
- Cu from foot baths
- Mycotoxins

Topic 4: Technical Issues

- Pre-treatment ✓
- Dosing ✓
- Fermenter size ✓
- Concept ✓
- Mixing

Why Mixing?

- Supply of bacteria with nutrients
- Transport of nutrients and waste materials
- Optimize utilization (retention time, loading rate)
- Support liberation of biogas
- Avoid and destroy swimming layers
- Avoid and destroy bottom settlements

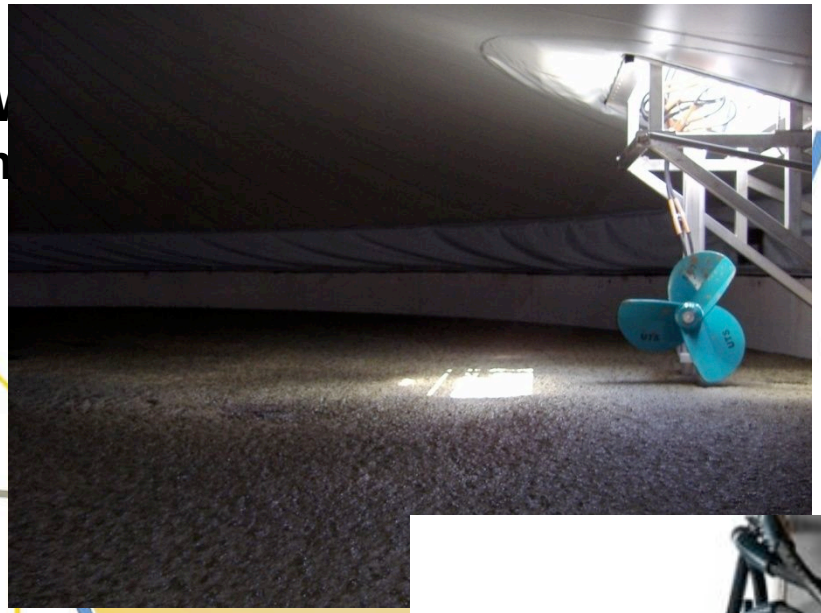
Factors influencing/determining Mixing

- Viscosity of substrate mix (dry matter, temperature, particle size)
- Necessary input power
- Revolution speed
- Agitator diameter/angle

=> Flexibility is required

Example of 1 MW
(German

SÖHNergy



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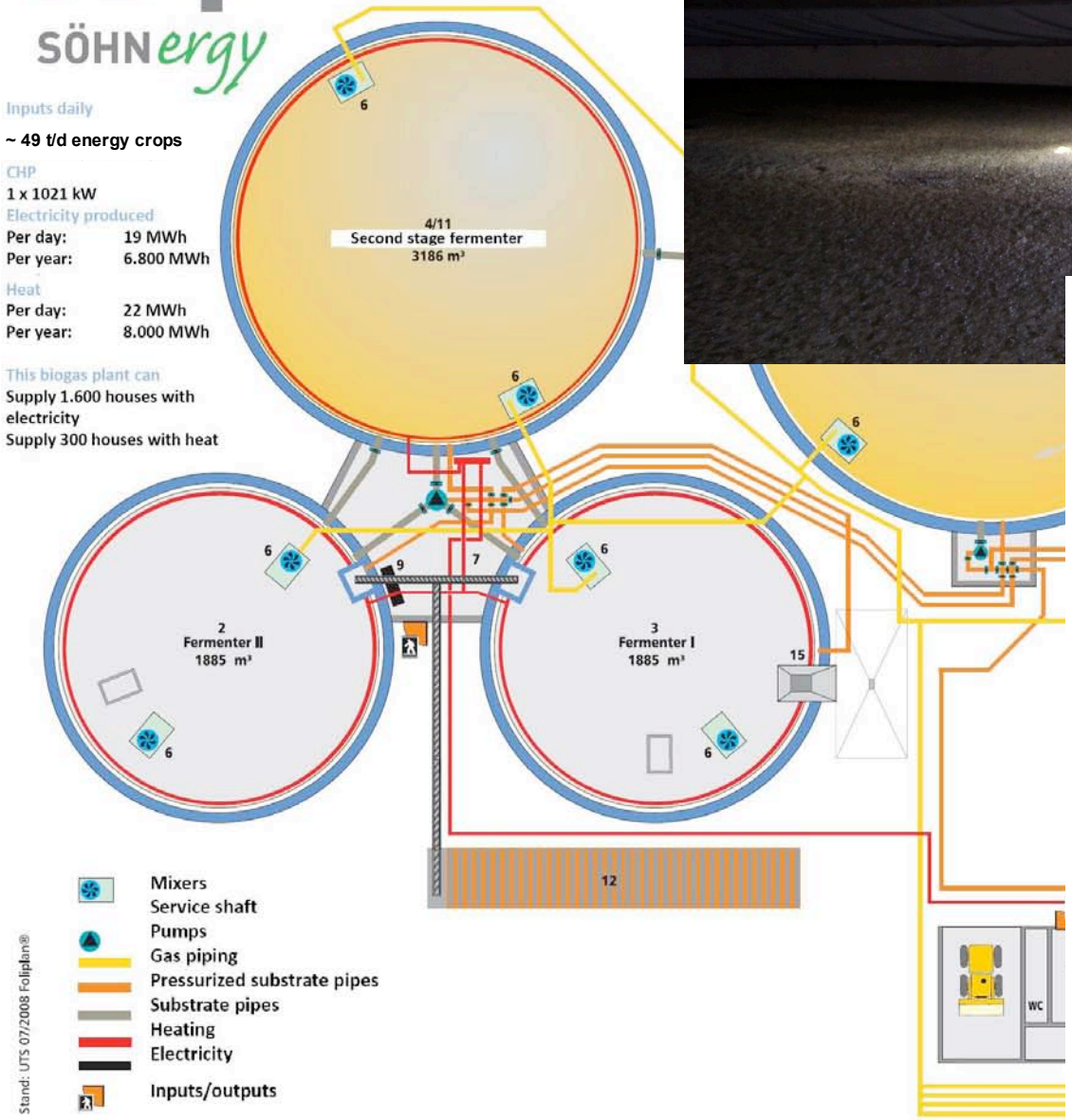
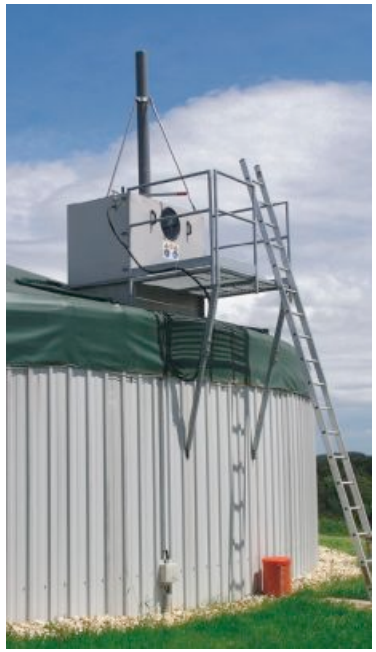
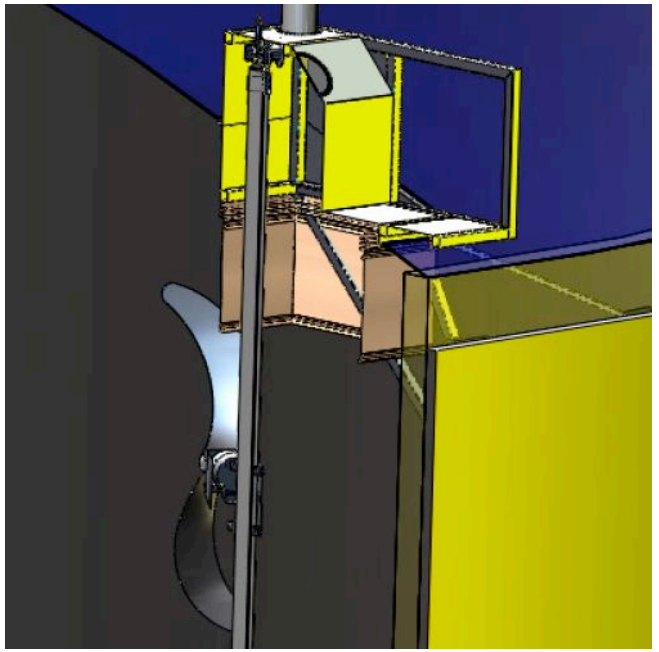


Mixer Service and Maintenance

- Regular service/maintenance intervals required
- Minimize impacts on performance/gas losses





Solution with UTS service box

Company Background

- **Established in 1992**
  as U.T.S. Umwelt-Technik-Sued GmbH
- Formation in 2007 as
  UTS Biogastechnik GmbH
  (**U**niversal **T**echnology **S**ervices for Biogas)
- Unmatched experience from > 1,500 plants with multiple feed-stocks
- Active in several European countries
  (Germany, Spain, Italy, Czech Republic, Hungary, Austria,
  Great Britain, Netherlands etc.)
- Multiple international patents on technologies and components, all designed to make for highly reliable plants

Scope of Supply

- **Turn-key supply of biogas plants**
  Design, planning/engineering, execution/errection, components, turn-key solutions
- **Technology for manure, waste handling and energy crops**
  Pumps, hydraulic/electronic mixers, mechanical separators, substrate dosing stations etc.
- **Electronic process control with remote monitoring capabilities**
- **Biological support**
- **Spare parts / technical service**
- **Construction services**
- **Concepts for financing and insurance**

UTS Biogas Plants

Reliable Biogas Technology.

UTS

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Thank you very much for your attention!

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