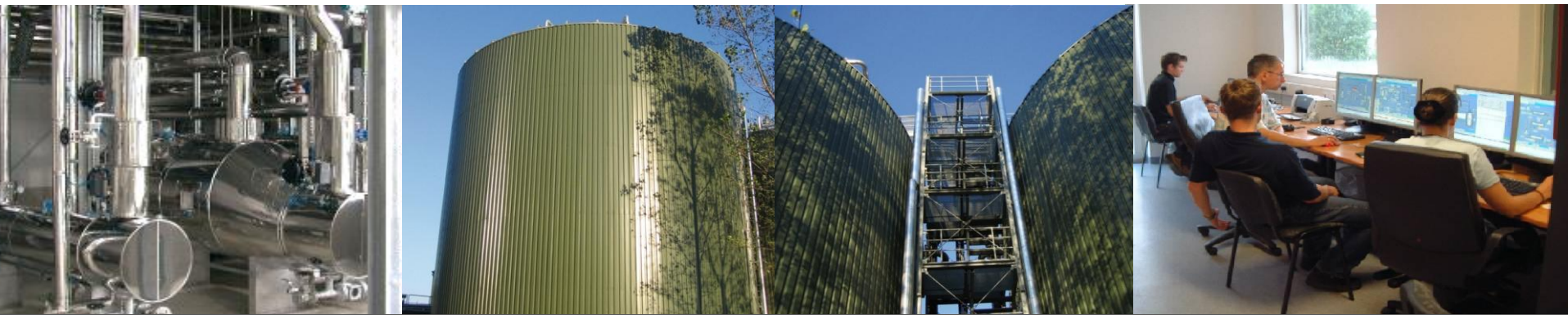


Improved profitability by combining Wet Anaerobic Digestion with Composting

USCC Conference, Santa Clara, CA
Klaus Ruhmer
1/25/2011



www.enbasys.com

Our future. Clean energy.

in partnership
and cooperation with

BDI 

Presentation outline

- **Introduction**
- **Waste to BioGas in multiple stages**
- **Profitability factors**
- **ENBA**FERM** – Anaerobic Digestion Technology**
- **Pre- and Post Treatment (ENBA**SEP** / ENBA**AIR**)**
- **Case study – Europe’s largest BioGas & Composting facility**
- **Conclusions**

Who is [®]enbasys



enbasys gmbh

USA: Austin, TX

Headquarters: Grambach/Graz, Austria

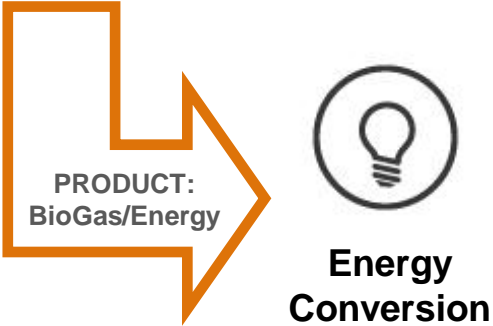
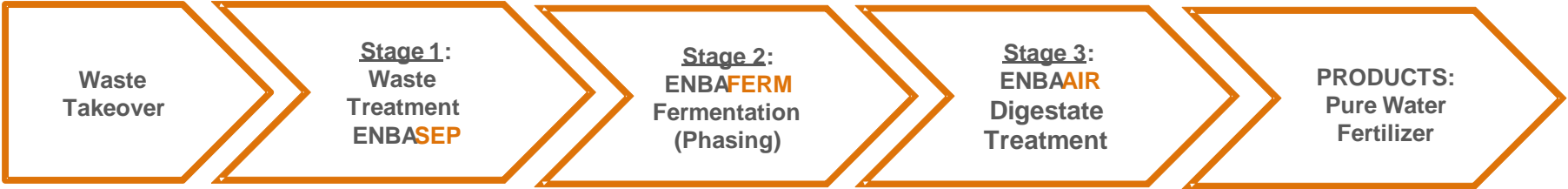
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**Design, engineering & construction of
tailor-made BioEnergy (BioGas,
BioDiesel) facilities globally**

Consulting – R&D – Engineering – Construction – StartUp - Support

Waste to BioGas – Multiple Stages



Profitability Factors

- **Co-Location**
 - » BioGas facility combined with composting facility (flexibility for waste streams)
 - » BioGas facility combined with industrial waste source (food or beverage processing, rendering, breweries, biofuel facility, etc.)
- **Tipping Fee**
 - » Largely depending on local circumstances (policy, local laws, diversion goals, etc.)
- **Energy revenue**
 - » Local circumstances, RPS (Renewable Portfolio Standard), Feed-In Tariff
- **Anaerobic Digestion Technology**
 - » 100% uptime, no sediments, highest conversion efficiency, feedstock flexibility
- **Capital investment**
 - » Small footprint, small reactors, proven suppliers, performance guarantees

Stage 1: Substrate Management



- **Waste takeover facility**
 - Closed building w/ truck take-over & washing
 - Negative pressure & bio-filters (NO odors)
 - Waste stream management (blending, mixing, storage, etc.)
 - Trained personnel
- **Separation Equipment**
 - Automated waste/packaging separation
 - High throughput
- **Waste Processing Equipment**
- **Key requirements:**
 - Removal of impurities
 - Particle size reduction
 - Ability to deal with changing feedstock
 - Substrate preparation for Anaerobic Digestion

Stage 1: Substrate Management



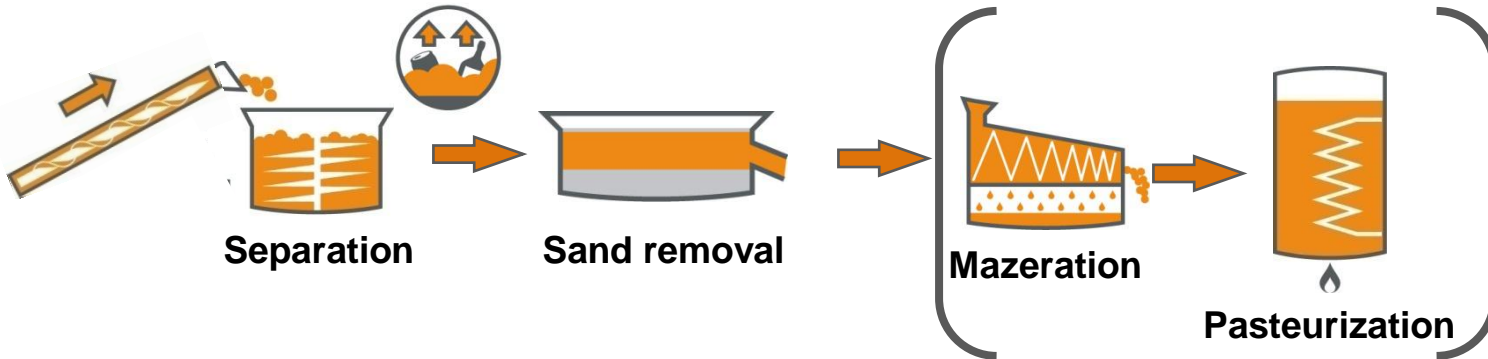
Transports



Bunker



Crushing



ENBAFERM Anaerobic Digestion

ENBASEP Separation Process



ENBASEP Example

Feedstock	≤ 10 t/hr Packaged Food Waste; SSO
Location	Benet, France
Customer	SIFDDA / SARIA
In operation since	2010



Stage 2: ENBAFERM Anaerobic Digestion



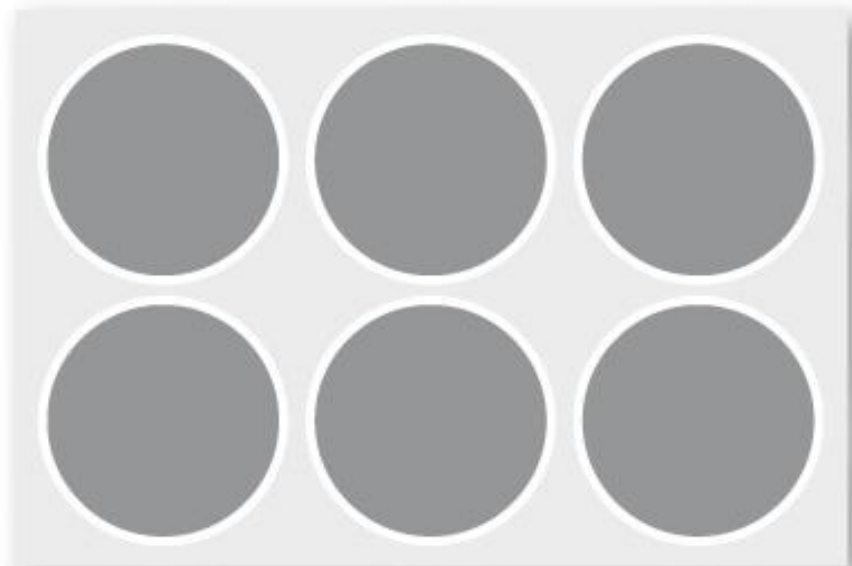
- **High-Load Hybrid Anaerobic Digestion**
 - Patented **ENBAFERM** technology
 - Combines advantages of UASB & CSTR
 - Unique temperature range
- **Key requirements:**
 - High loading rate (>10kgCOD/m³/day)
 - Small footprint (= lower cost)
 - Sediment prevention
 - Foaming prevention
 - 100% uptime
 - Highest possible concentration of micro-organisms
 - Ability to deal with changing feedstock (single feedstock or multi-feedstock)
 - Full automation

Footprint

Footprint when using the
same amount of feedstock

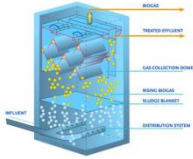
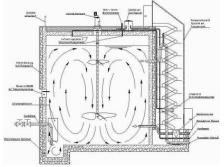




ENBAFERM



Conventional

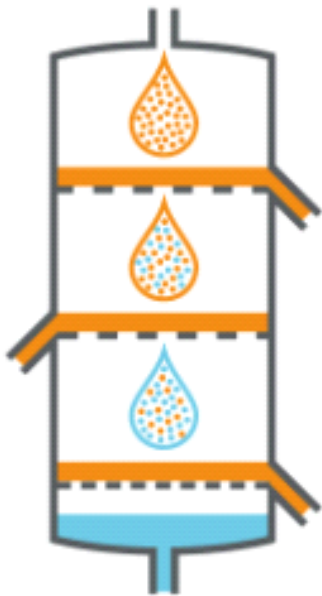
Technology Comparison

	UASB 	CSTR 	DRY 	ENBAFERM 
Feedstock flexibility	Poor	Good	Medium	Good
Total Solids for input substrate	< 0.5%	5-90%	20-40%	5-90%
Nitrogen & Sulfur tolerance	Poor	Poor	Good	Good
Ability for mono-fermentation	Good	Poor	Poor	Very good
Loading rate / efficiency	Very High	Low	Medium	High
Continuous Operation	Yes	Yes	No	Yes
Facility footprint / Reactor size	Small	Large	Large	Small
Operation process stability	High chemical cost Process sensible to fat and particles	Floating Layers Sediments Dead zones	Inoculation needed Dead zones	Minimum Maintenance
Plant availability				

Stage 3: ENBAIR Digestate Treatment

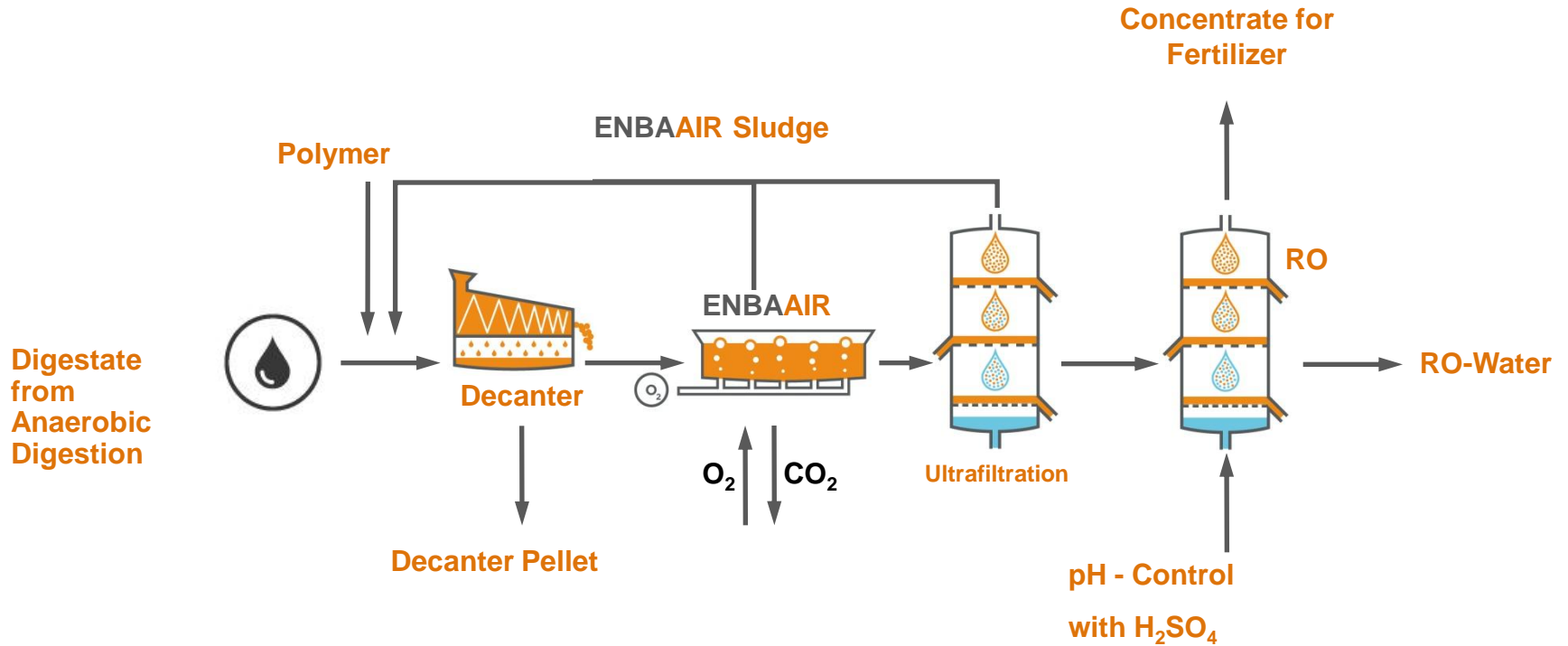


- **Digestate Treatment**
 - Liquid / Solid separation
 - Aerobic & MBR treatment of waste water
 - Purification through Filtration & RO (optional)



- **Key requirements:**
 - Optimized waste water conditioning for re-use or discharge
 - Solids added to composting operation or sold as fertilizer
 - Full automation

Stage 3: ENBAAIR Digestate Treatment



Energy Conversion



- **BioGas Conditioning**

- Moisture removal
- Sulfur removal
- Conditioning for gas-feed in
- Conditioning for fuel cell
- Conditioning for turbine or gas engine

- **Key requirement:**

Maximum profitability through optimized energy product based on local circumstances (e.g. feed in tariff, local incentives, etc.)

Case Study: Largest Plant in Europe

“Municipal organic waste to energy” – Largest Plant in Europe (Italy)



Technical details:

Feedstock: organic fraction of municipal solid waste (OFMSW), food industry waste, slaughter house waste, biofuel residues

Input: about 200k tons/y for composting
about 105k tons/y for AD

Fermenter system: 2 x 2900m³, loading rate 10 – 13 kg COD/m³

Products:

BioGas:	1.450 Nm ³ /h (59% CH ₄)
Electricity:	3,4 MW _{el} (27 GWh/y)
Purified Water:	43.827 m ³ /y
Fertilizer:	47.173 m ³ /y

Case Study: Largest Plant in Europe

HIGHLY PROFITABLE BECAUSE ...

- **Co-Location with Composting facility**
 - » All organic waste is processed (pre-AD, e.g. wood, brush, larger particles, etc.)
 - » Post AD effluent goes into composting (varies by season, local laws, etc.) = **Flexibility!**
- **Tipping Fee**
 - » High tipping fee due to strict local regulations and limited landfill space
- **Energy revenue**
 - » High feed-in tariff (> 2x regular kWh price) due to local regulations
- **Anaerobic Digestion Technology**
 - » Non-stop operation for > 5 years, Loading rate > 10kg COD/m³/day

U.S.A. Project: Columbia Biogas

Feedstock	100 000+ t/yr Packaged Food Waste; SSO, ...
Location	Oregon
Energy production	~ 5 Mw_{el}
Customer	Columbia Biogas
Engineering / Construction	2010/2011
Operation	Mid 2012



Reference in Turkey

Feedstock	50 000 t/yr SSO; OFMSW; Agricultural Residues
Location	Pamukova, TR
Energy production	~ 1.4 MW_{el}
Customer	Biosun / Hexagon Group
Start-up	1st Quarter 2011



Thank you very much for your attention!

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