Generating resources from wastewater through biotechnology

revitalizing resources

Environment Day

Date: 05-06-2014

Place: FIESP, São Paulo/SP

Author: Sérgio Cruz

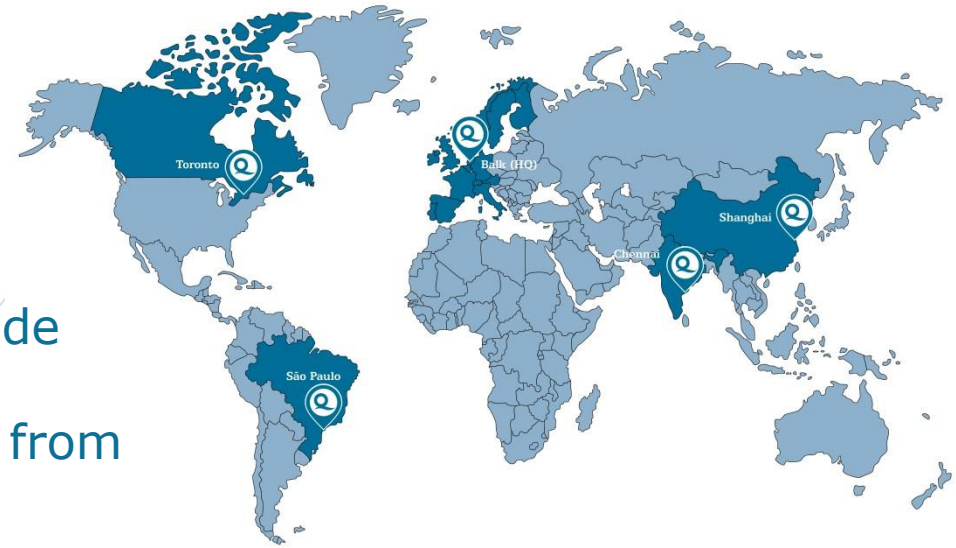
PAQUES

Who is Paques?

- Founded in 1960
- Number of employees : 400
- Innovative biological solutions to purify wastewater and gas

Paques helps companies to:

- Meet safe water discharge requirements
- Reduce water consumption
- Produce green gas & upgrade biogas
- Recover valuable elements from used water



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Brazil

The Netherlands

China

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Applications and Technologies

AREA	APPLICATION	TECHNOLOGIES
CARBON	ANAEROBIC & AEROBIC WASTEWATER TREATMENT	BIOPAQ®IC BIOPAQ®UASB+ BIOPAQ®AFR BIOPAQ®UBOX CIRCOX®
SULPHUR	(BIOGAS) DESULPHURISATION	THIOPAQ® BIODESOX®
NITROGEN & PHOSPHATE	(DE)NITRIFICATION PHOSPHATE RECOVERY	ANAMMOX® PHOSPAQ™ ASTRASAND®
METALS & CHEMICALS	METALS RECOVERY SULPHIDE PRODUCTION SULPHATE REDUCTION CHEMICALS RECOVERY	THIOTEQ™ SULFATEQ™ BIOMETEQ™ IONPAQ™
SEPARATION	BIOFILTRATION AND SOLIDS REMOVAL MEMBRANE FILTRATION	ASTRASAND® ASTRASEPARATOR®

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Scope and Partners

- Process design
- Basic and detailed engineering
- Manufacturing
- Contracting
- Construction
- Research & Development
- Laboratory services
- Pilot testing

Friedrich-Alexander-Universität Erlangen-Nürnberg

Advanced Water and Environmental Management Company KURITA WATER INDUSTRIES LTD.

WAGENINGEN UNIVERSITEIT WAGENINGEN UR

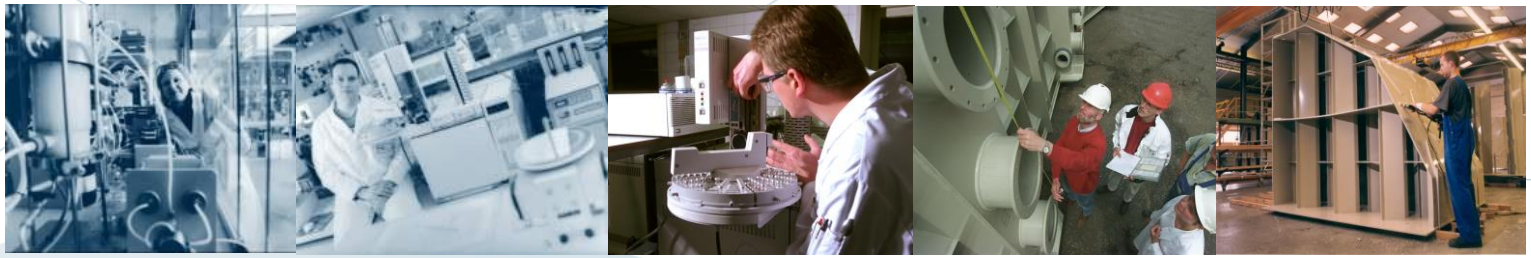
TU Delft

wetsus centre for sustainable water technology

IHI Ishikawajima-Harima Heavy Industries Co., Ltd.

Radboud Universiteit Nijmegen

NWP Netherlands Water Partnership



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References

Worldwide leader in anaerobic treatment. More than 2.000 plants installed in more than 60 countries in the following industries:

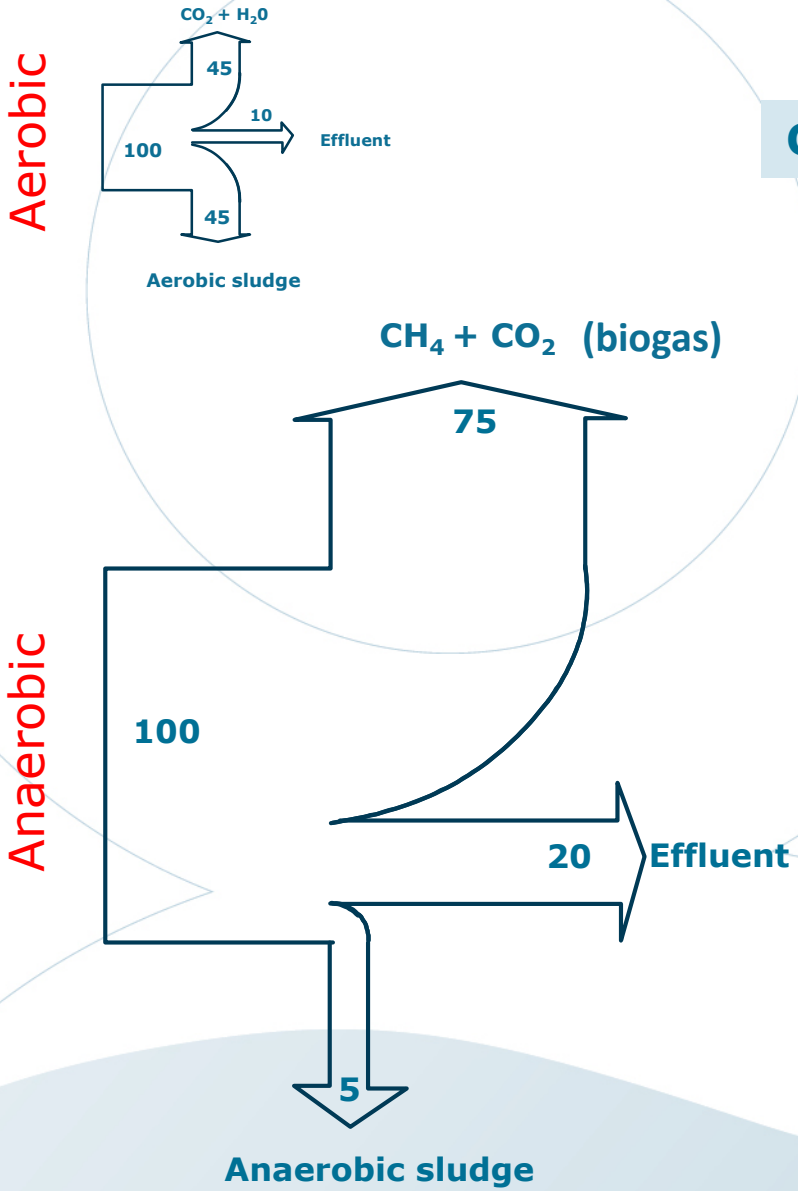
- Pulp and Paper
- Beer and Beverages
- Food
- Distilleries
- Chemical industry
- Metal and Mining
- Oil and Gas
- Municipalities

Since 1984 in Brazil - more than 200 plants installed.

Ecological impact

- 10 million tons of organic pollution treated per year
- Enough biogas produced to supply 3 million households with energy
- Reduction of CO2 emissions by 25 million kg/day

Anaerobic wastewater treatment



$$COD \longrightarrow CH_4 + CO_2 + BIOMASS$$

Anaerobic methanogenic biomass

- Production of reusable methane (green energy)
- Low sludge production (& biomass is asset rather than waste)
- Granular biomass

Anaerobic biomass

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BIOPAQ®IC anaerobic reactor

- High rate (20-30 kg COD/m³/d)
- Small footprint
- Low hydraulic retention time
- Self regulating system
- Intensely mixed biomass at bottom reactor
- Optimal sludge retention at top reactor
- 1.000 installed worldwide

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Brasserie Kronenbourg
Beer
France
13 tpd COD

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Hansol Paper
Paper
Korea
42 tpd COD

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Botian Sugar Yian Qiqihaer
Food
China
200 tpd COD

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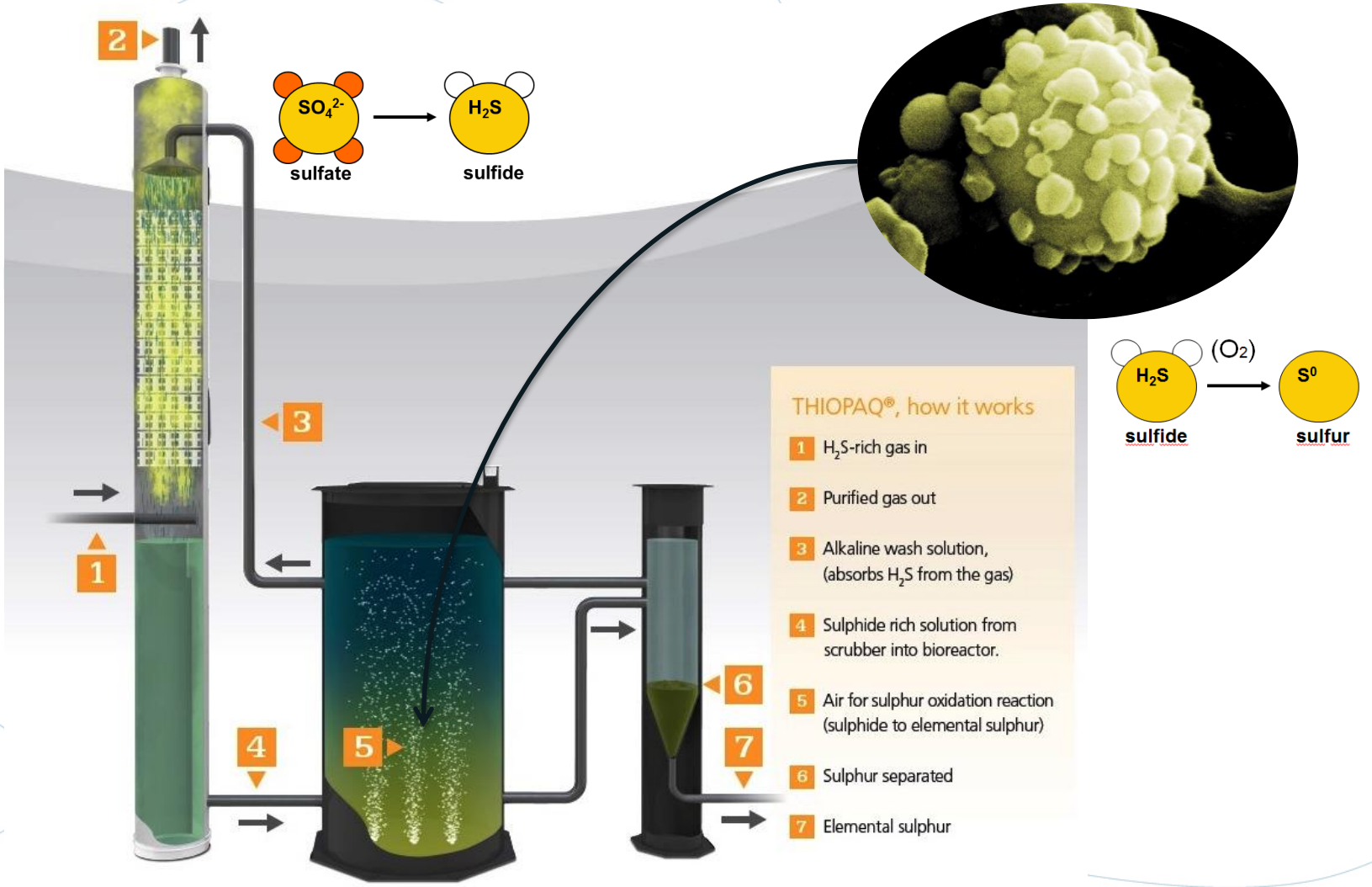
THIOPAQ®: Biogas desulphurisation



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Hydrogen sulphide is converted to hydrophilic sulphur
Spent caustic is biologically regenerated to ~90%

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Why choose THIOPAQ®

- Deep H_2S removal: below 25 ppm
- High uptime and reliable process: 98% uptime, no plugging
- No air or oxygen input in biogas
- Low total cost of ownership: 90% reduction on caustic consumption
- Sulfur production: fertilizer or fungicide

THIOPAQ® applications

- Industrial biogas
- Natural gas
- Refinery gas
- Landfill gas
- Associated gas
- Solids digester biogas

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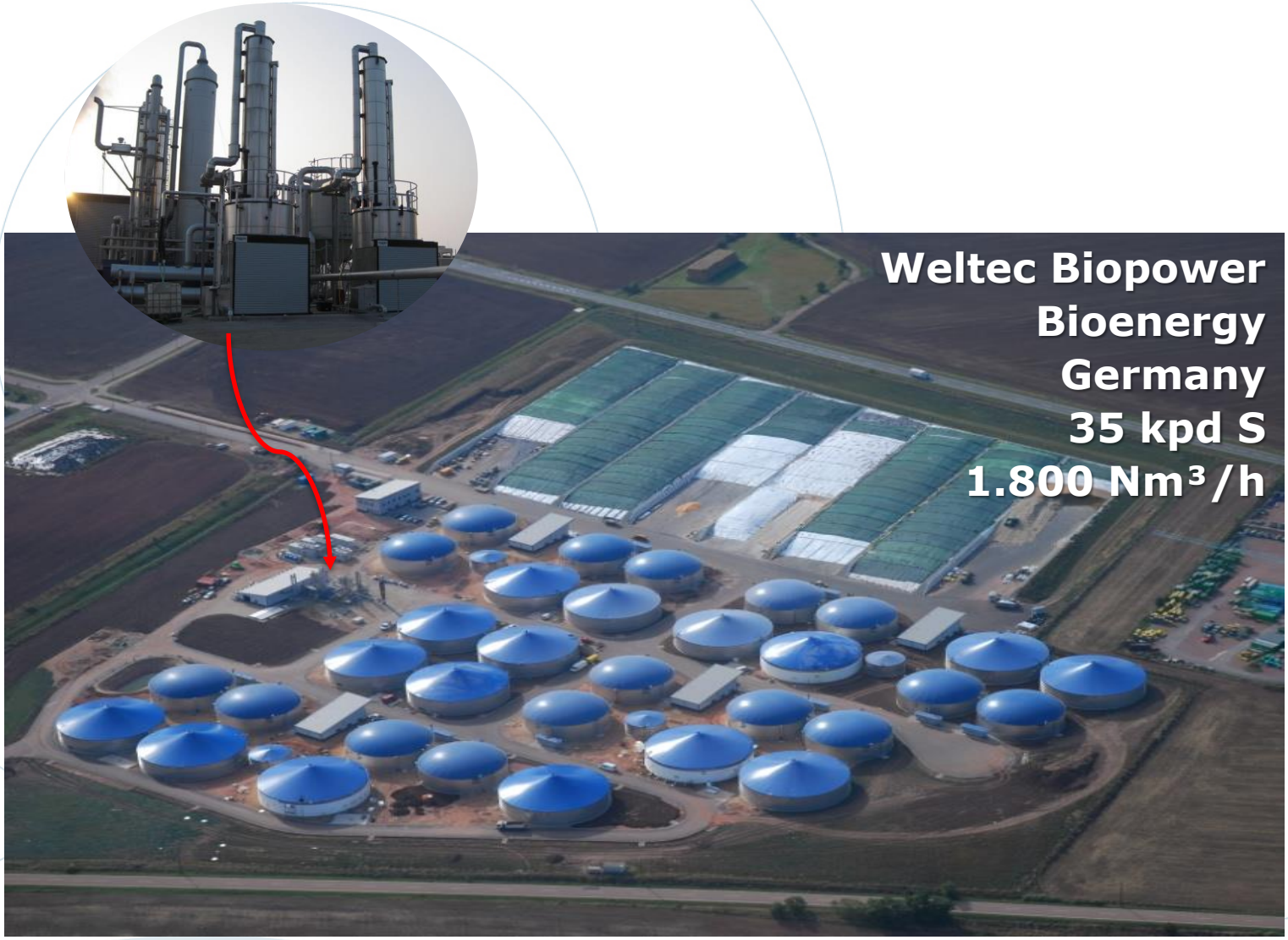

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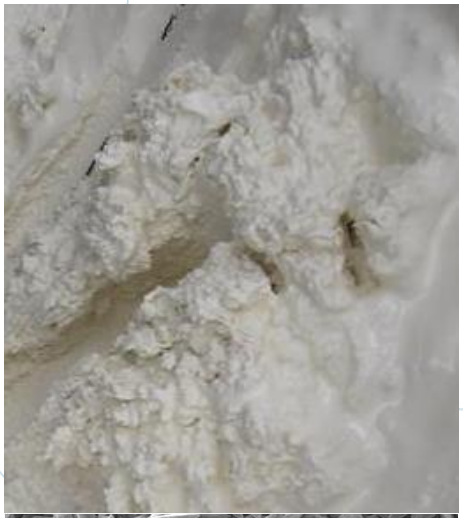
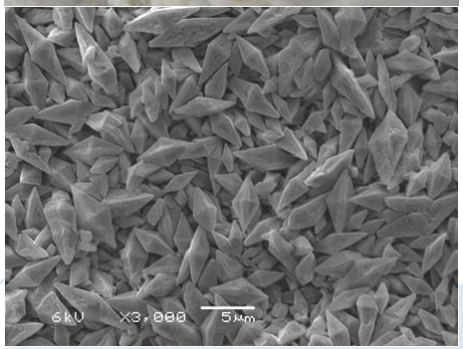
FERTIPAQ®: Sulfur back to nature as fertilizer

FERTIPAQ
Natural Solutions





Currently, 20.000 tons of biosulfur per year are produced by THIOPAQ® installations worldwide

- Color: white/yellowish
- Smell: none to neutral
- Density: 1.3 kg/liter
- S-content: 600 g/liter
- Easy dilution with water (Hydrophilic)
- Very fine particles 2 –10 microns
- No blocking of sprays
- Long term nutrition effect in the soil

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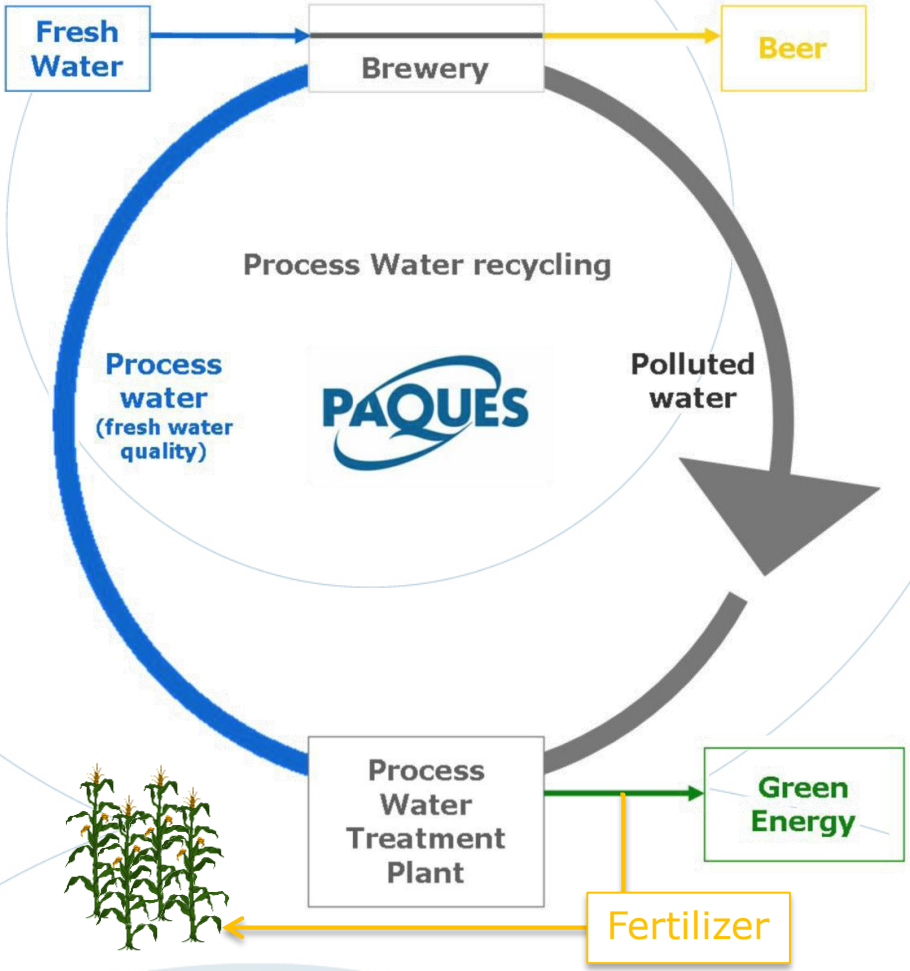
Closing the cycle: converting wastewater into energy and fertilizer



Case study brewery 2.000.000 hl

Reduction discharge costs
* save money: **€ 800.000,--** per year

Water savings
400.000 $m^3/_a$
* save money: **€ 220.000,--** per year

Energy savings
400.000 $m^3/_a$, 20^0C heating
* save money: **€ 320.000,--** per year

Biogas production in PWTP:
= 616.000 $Nm^3/_a$
* money: **€ 320.000,--** per year

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A brewery that produces 1 million liters/day of beer will also produce 3.000 Nm^3/day of biogas

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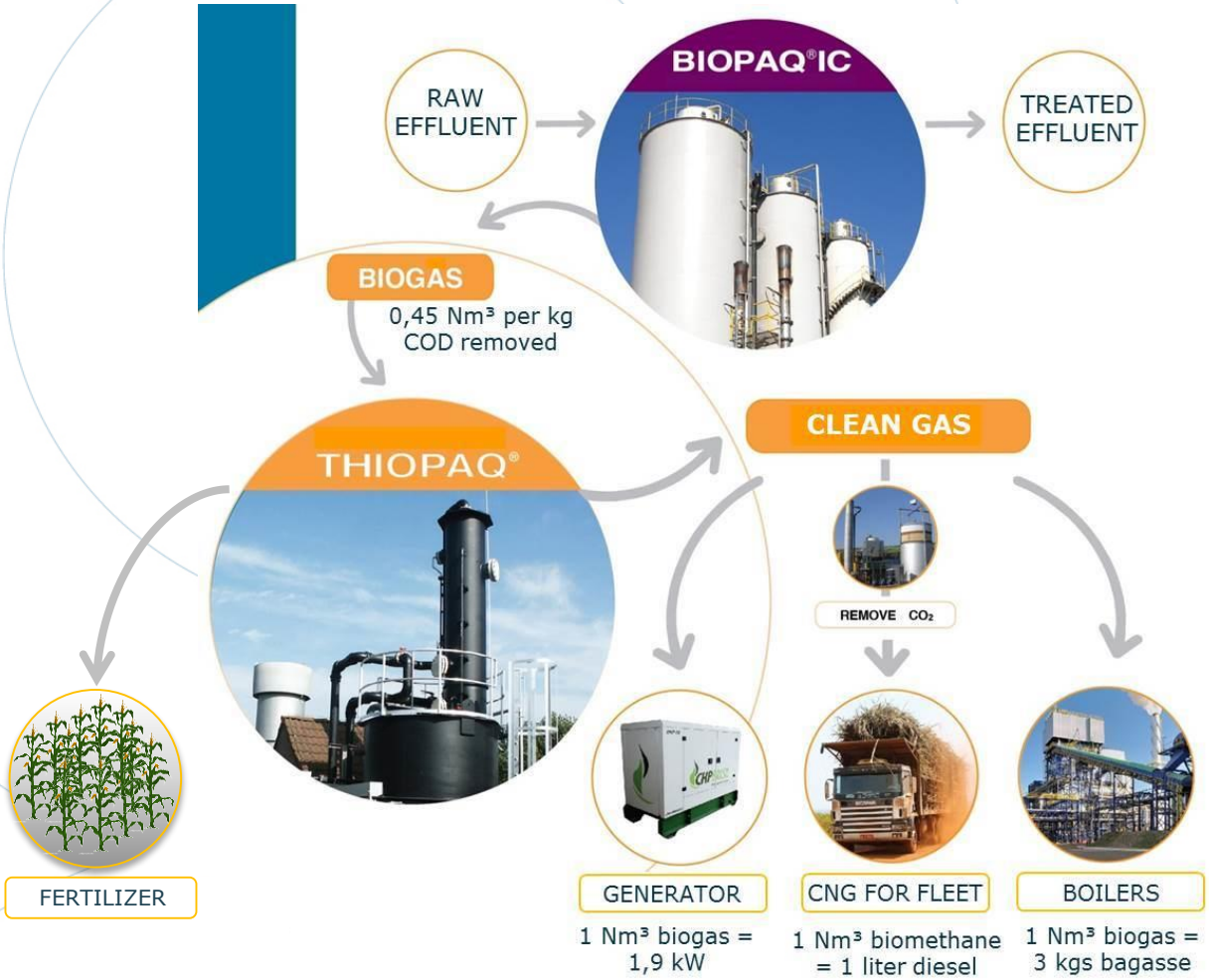
Closing the cycle: converting wastewater into energy and fertilizer



A distillery that produces 1 million liters/day of ethanol can also produce 83.000 Nm³/day of biogas

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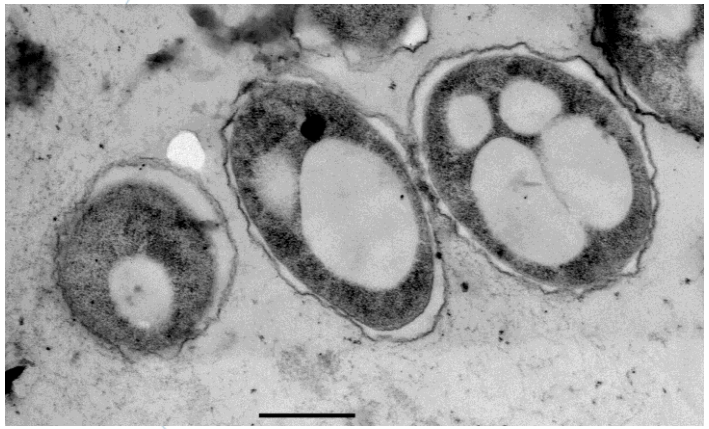
Under research: bioplastic from wastewater



- Poly-b-hydroxyalkanoate (PHA)
  - Common and widespread storage material in microorganisms
- Storage up to 90 wt% in granules
- Properties similar to petrochemical plastics
- Biodegradable
- Made from renewable resources

Van Loosdrecht & Kleerebezem

TU Delft Delft University of Technology

STW

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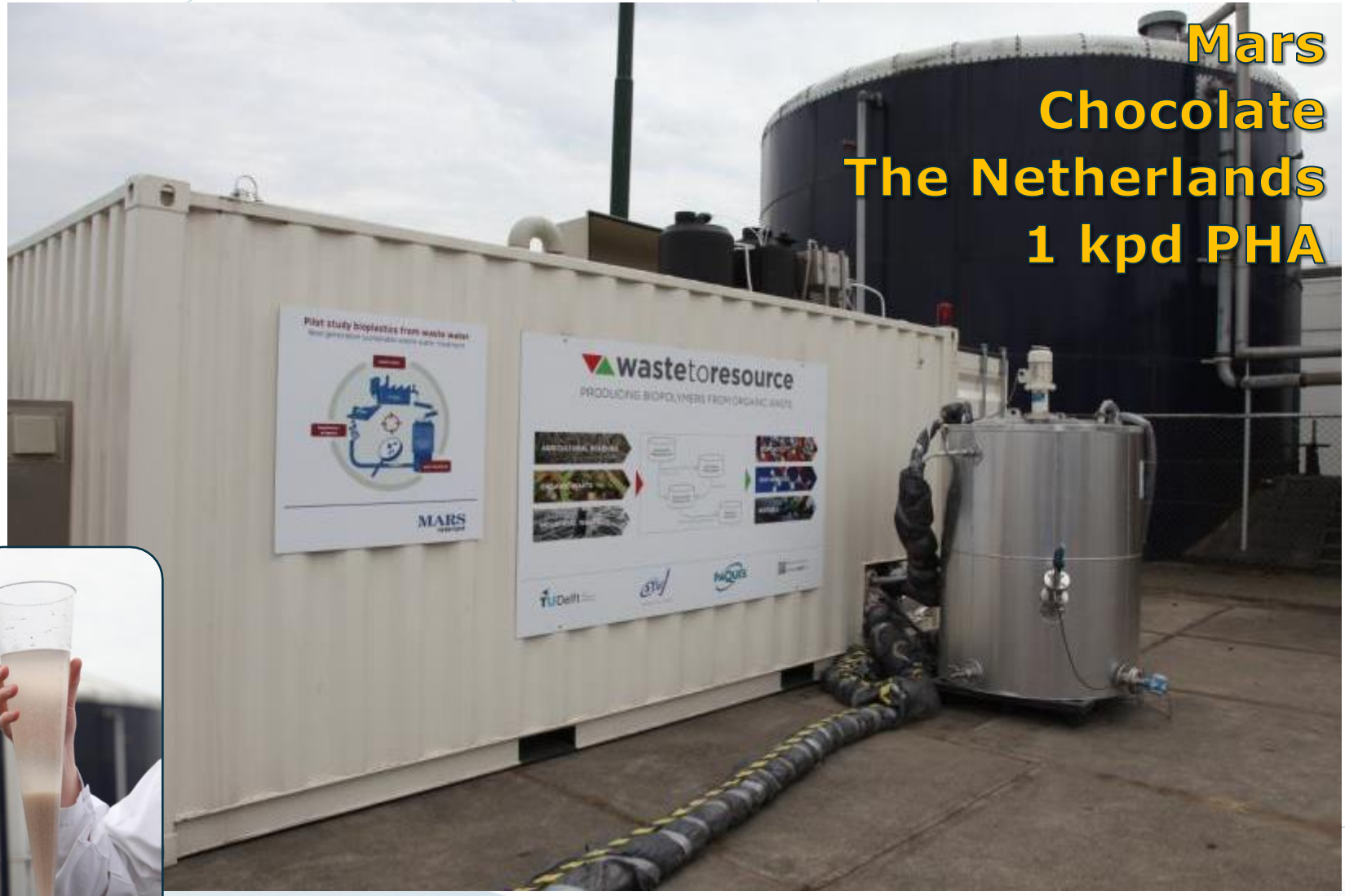
First results: bioplastic from chocolate!



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UBOX®: How it all started…

Conventional domestic sewage treatment (WWTP Piracicamirim – Piracicaba/SP)

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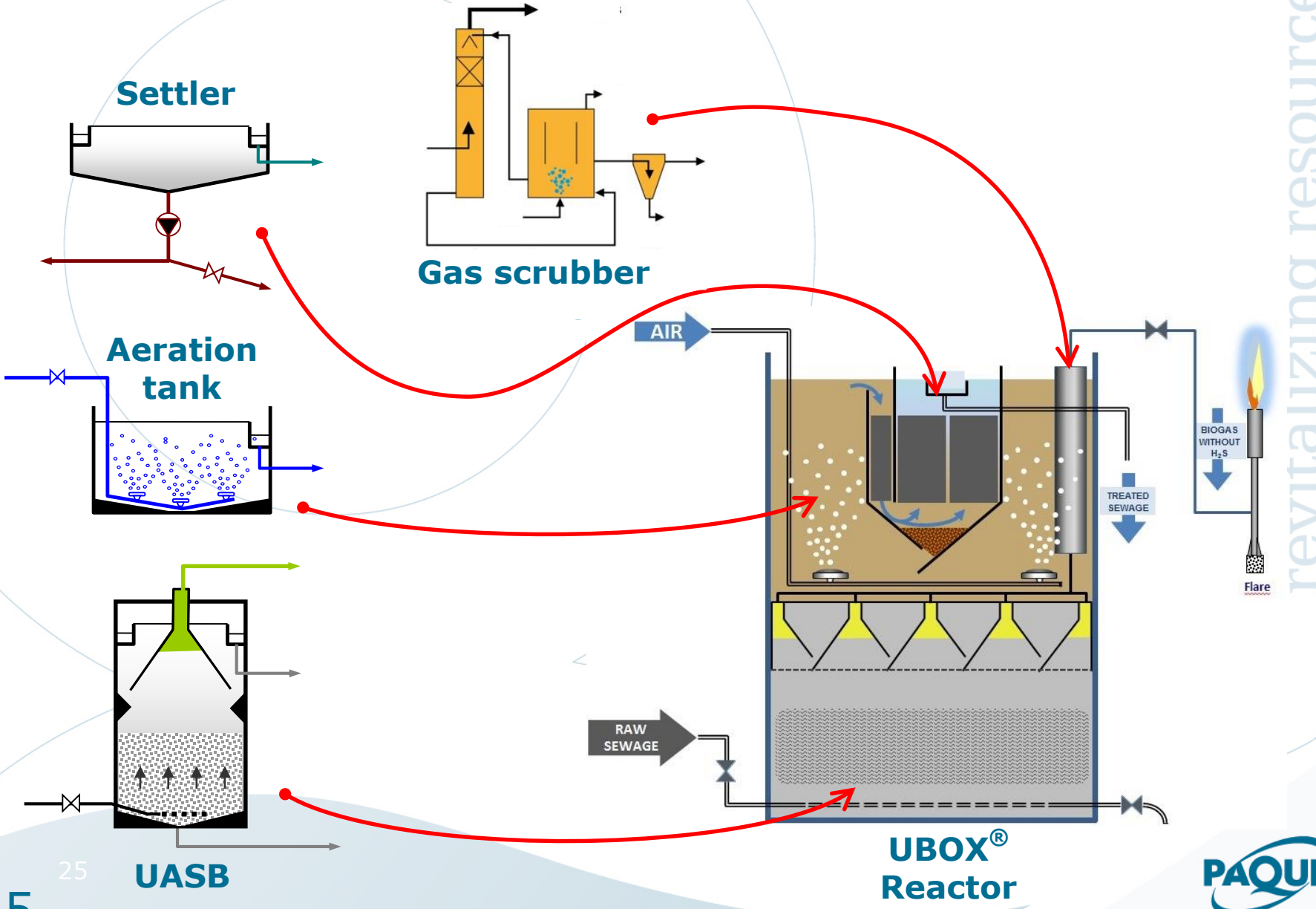
UBOX®: Making it simple



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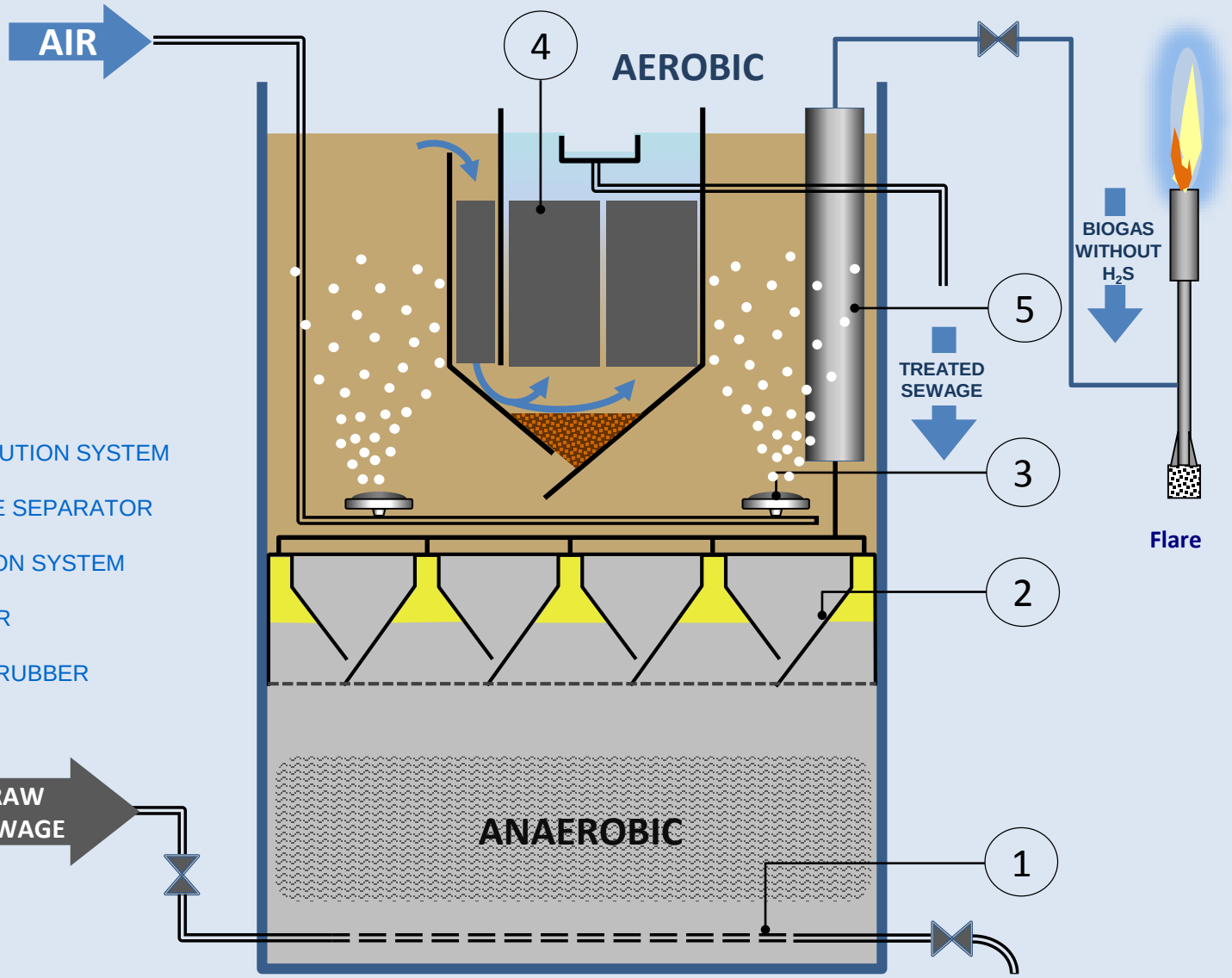
UBOX®: All-in-one



1. DISTRIBUTION SYSTEM
2. 3-PHASE SEPARATOR
3. AERATION SYSTEM
4. SETTLER
5. GAS SCRUBBER

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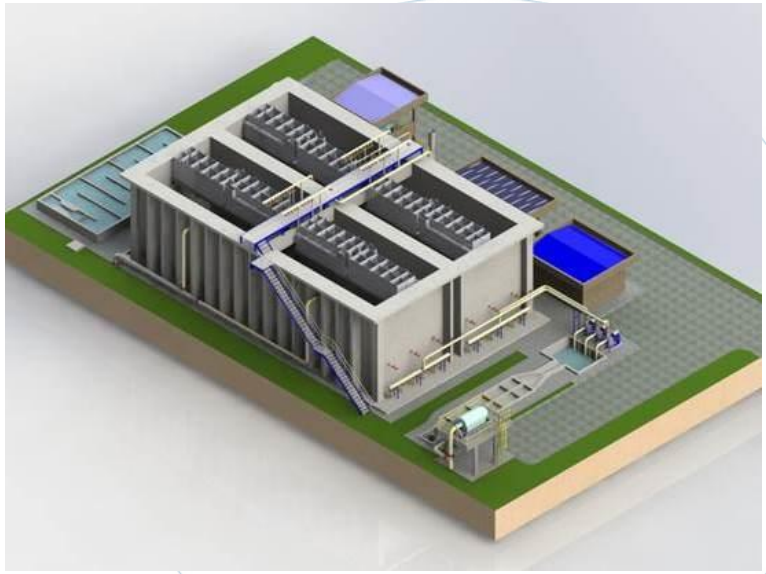
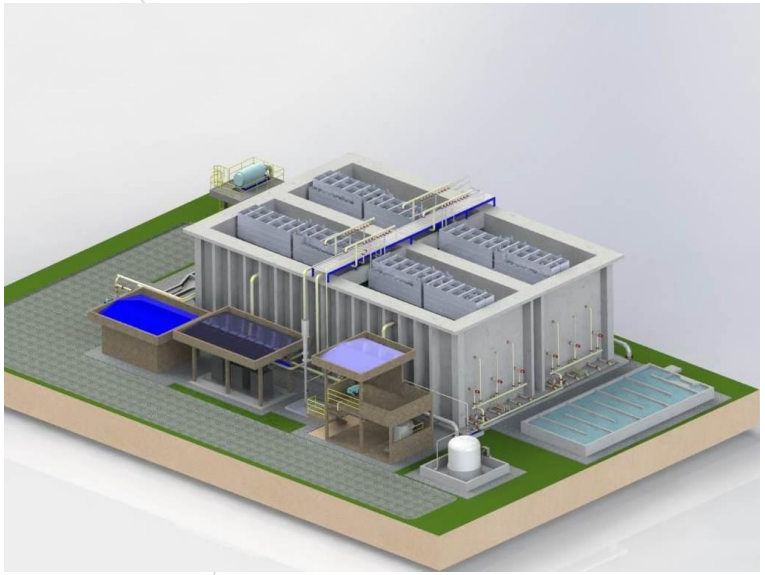
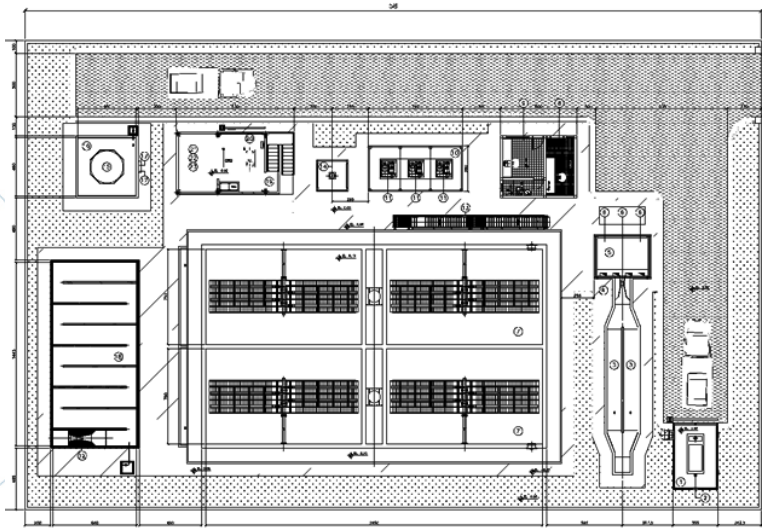
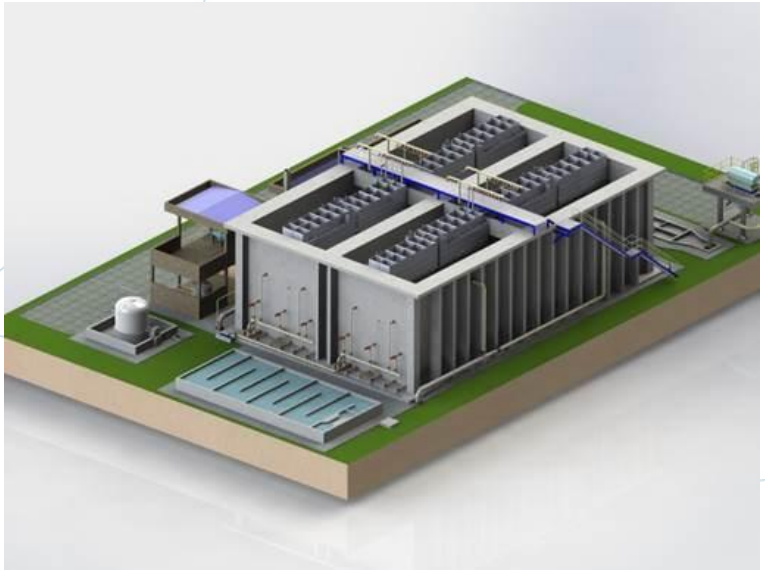
UBOX® design









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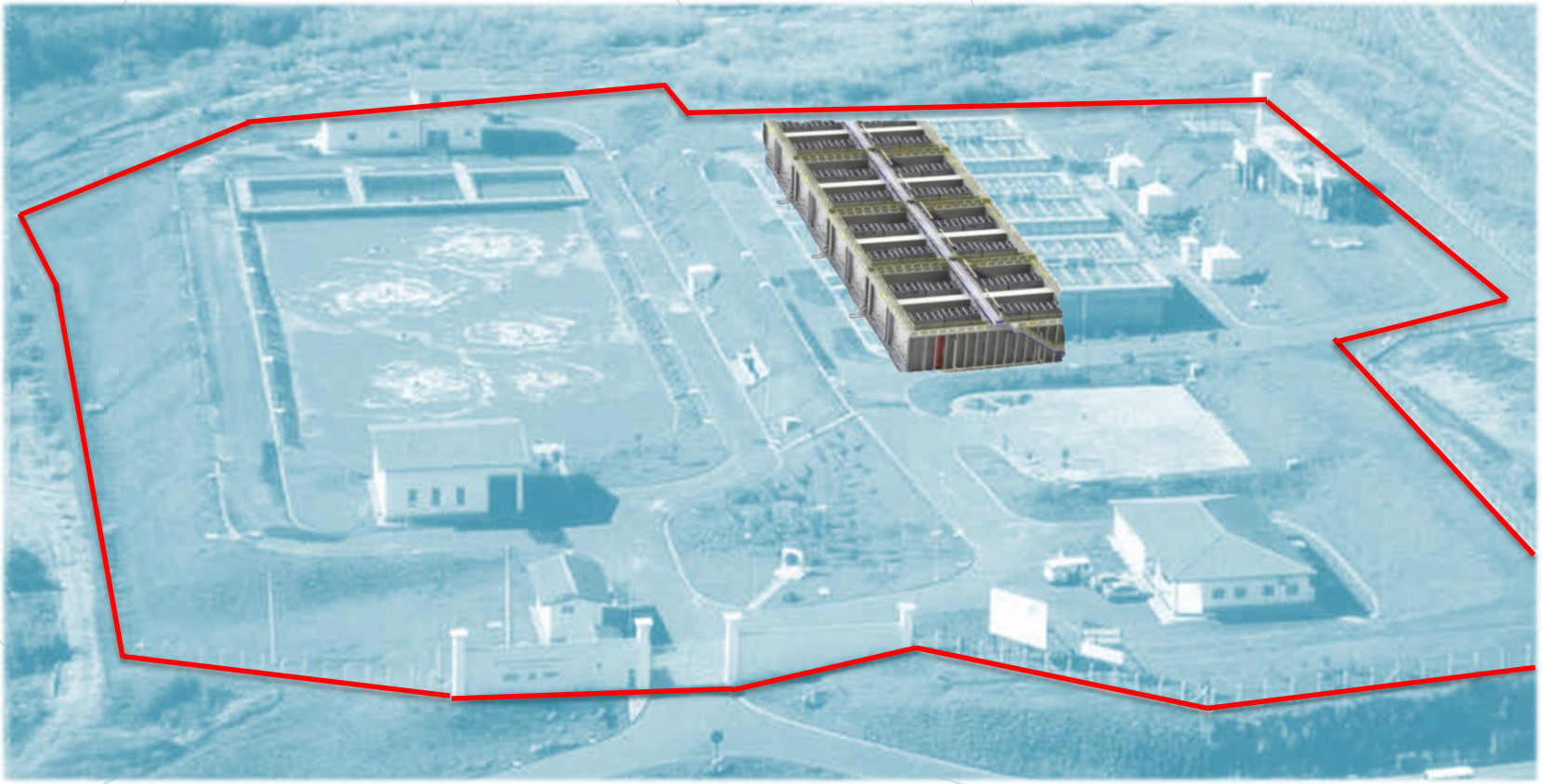
UBOX®: Footprint savings



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UBOX®: Advantages

- **Low operational cost:**
  - 40% reduction on energy consumption
  - 60% reduction on sludge generation
  - No chemicals required
  - OPEX < R$ 0,20/m³ treated
- **Low environmental impact**
  - Zero odour emissions
  - Efficiency: BOD removal > 90%
  - Small footprint
- **High durability**
  - All reactor components built in PP, HDPE and stainless steel

Igarassu: 20.000 p.e.


Nova Odessa: 50.000 p.e.


Piracicaba: 10.000 p.e.


Camboriu: 5.000 p.e.

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Brazil: Quick market analysis

SECTOR	UNITS SOLD	DEMAND	THREATS	OPPORTUNITIES
Food, Beer and Beverages	123	Very high	• Competition • Slow economy	• Sustainability as marketing tool
Distilleries	2	Low	• Sector in financial difficulties • Energy abundant	• Increase of energy cost • 2nd Generation Ethanol • Regulations on fertirrigation
Pulp and Paper	3	Medium	• Water abundant and cheap	• Close water loop
Metal and Mining	0	Low	• Not familiar with biotechnology	• Metal recovery • Zero gypsum generation
Municipalities	9	Very High	• Public tender process • No worries about OPEX	• Concessions and PPPs

Thank you!
Obrigado!
Bedankt!

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