

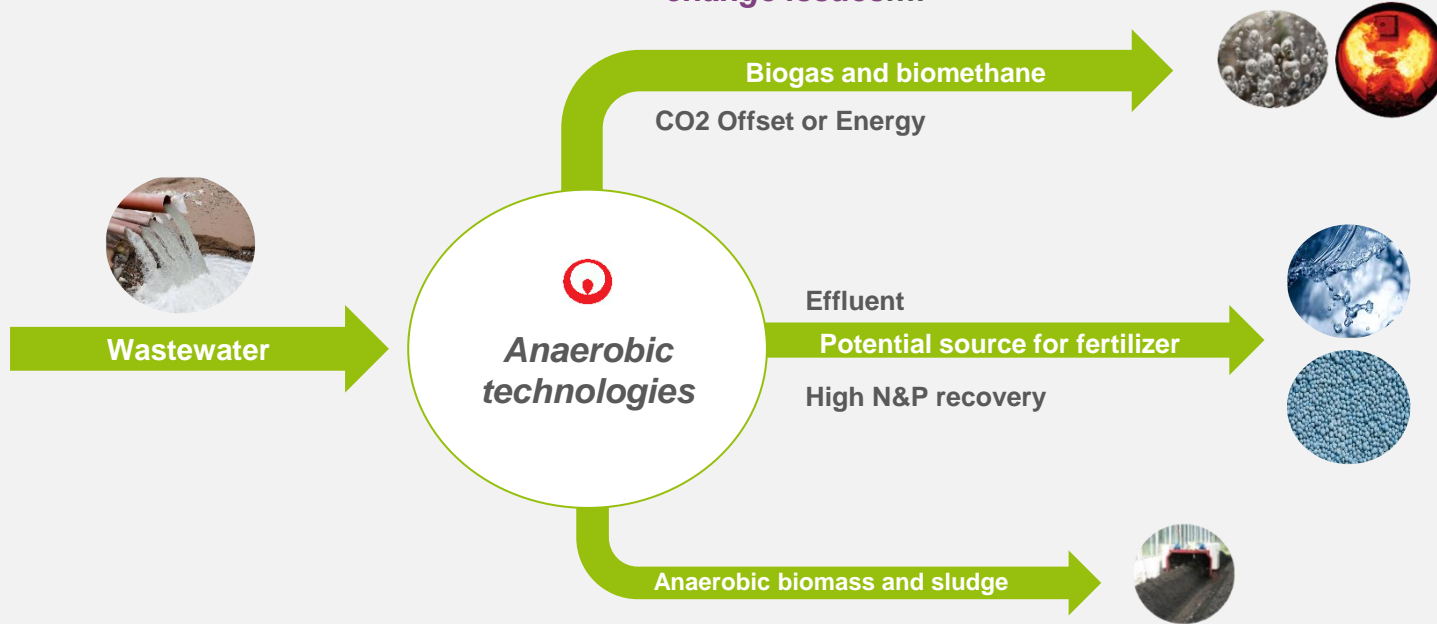


MemGas™ - Biogas Upgrading Technology by VEOLIA

WATER TECHNOLOGIES

WHY ANAEROBIC? Resourcing the world

“...Today, natural resources are becoming *increasingly scarce* while our needs are growing in an ever *more densely populated* and urbanized world facing *climate change issues....*”



INSIGHTS

Anaerobic treatment

10,000 kg COD/day



1. Energy consumption

~10,000 kWh

Aerobic

Anaerobic

~1,000 kWh

2. Carbon Footprint & Energy production

Euro ---



waste sludge

Euro ---



Volume
(VLR 1-3) and
Footprint
(H ~ 6m)

3. Waste & biomass



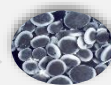
OFFSET > 4,000 ton CO₂ / year
> € 1,000,000 / year
+35,000 kWh / day

4. Footprint



Volume
(VLR 5-20) and
Footprint
(H ~ 18 m)

biomass



> € 200,000 / year

BIOTHANE

Driven by innovation

1973



UASB Pilot

1976



Biothane UASB

1984



Biobed EGSB

2000

300
references

2008



Veolia

2012

Sulfothane &
Memthane AnMBR

2010

Biobed
Advanced

2017

MemGas



2021

Sparthane &
Anoxthane



2022

Biobed EBS

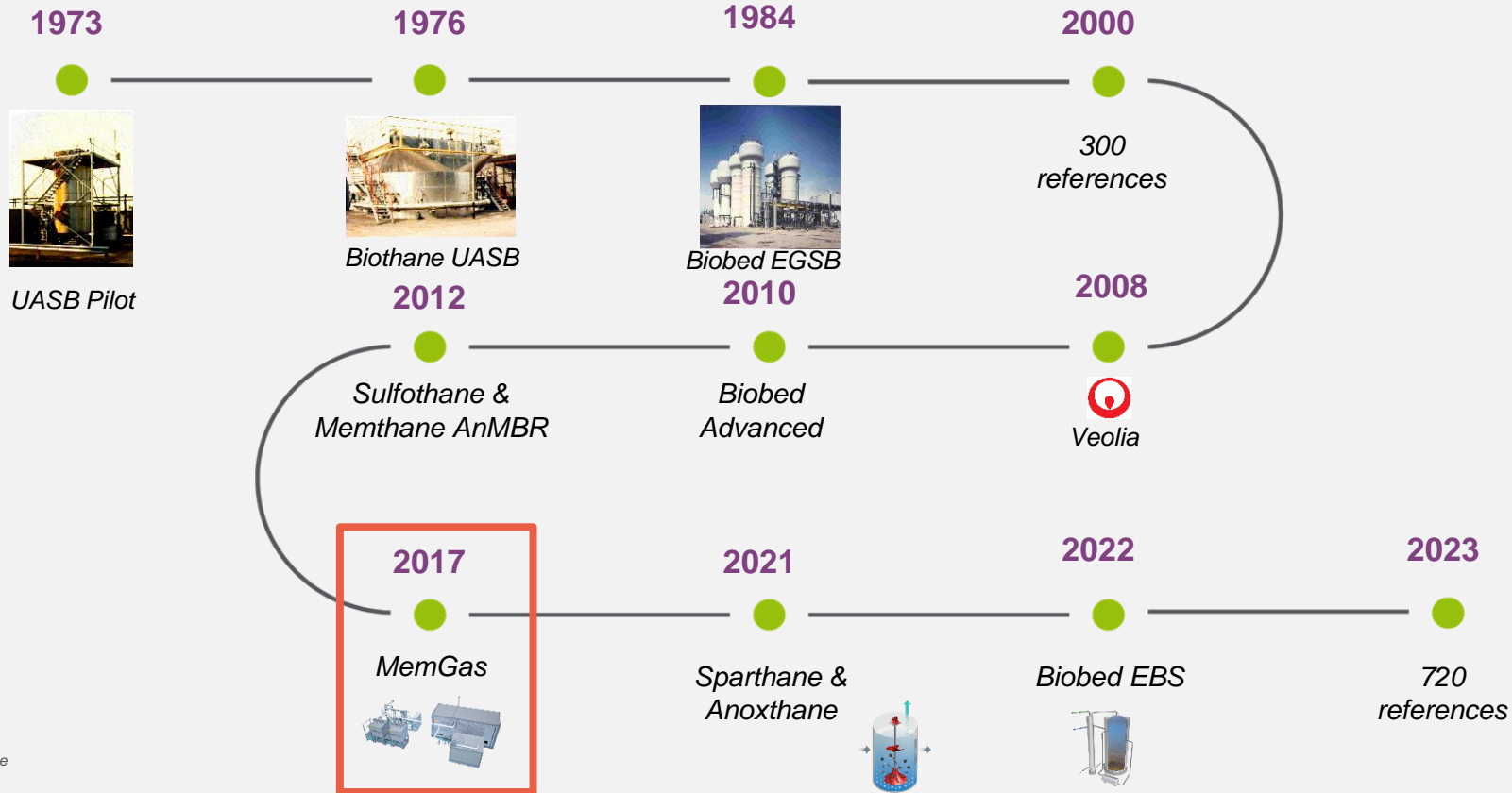


2023

720
references

BIOTHANE

Driven by innovation



BIOTHANE

Core markets



Food & Beverage

- Breweries
- Dairies
- Distilleries & wineries
- Sugar production
- Corn, starch & veggie processing
- Soft drink & juice processing



Energy & Chemicals

- PET, PTA, PIA, DMT
- other chemical types
- Biofuels



Pulp & Paper

- Recycle paper
- Fermentation & biofuels
- Soy & biodiesels production



Municipal

- Biogas upgrading
- Anaerobic sewage treatment

Value of biogas solutions



CONTEXT AT EUROPEAN SCALE

The European Commission has presented the REPowerEU Plan on the 18th of May, its response to the hardships and global energy market disruption caused by Russia's invasion of Ukraine.



ENERGY SAVINGS

Increase from 9% to 13% of the binding Energy Efficiency Target.



DIVERSIFICATION OF ENERGY SUPPLIES

Work with international partners to diversify supplies like LNG imports and develop a joint gas purchasing mechanism on behalf of Member States.



ACCELERATE ROLL-OUT OF RENEWABLE ENERGY

Increase the 2030 target for renewables from 40% to 45% among which **35bcm*** of biomethane.



FIT FOR 55'

Reduce net greenhouse gas emissions by at least 55% by 2050 to make **Europe carbon neutral**.

*billion cubic meters

CONTEXT

VALUE OF BIOMETHANE

Biomethane is composed of 2 values
Intrinsic Energy (MWh) + “**Green value**”

The **Intrinsic Energy** value is in competition with fossil energies:
→ Natural gas
→ Fuel for vehicles



The **Green value** has to make the model sustainable, it could be under the form of :

- Governmental support with **Feed in tariff**
- **Guarantees of Origin** - 1 GO = 1 MWh
- **Carbon Credits** - 1 Credit = 1 t

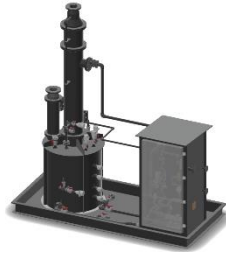
1 MWh avoids the emission of 0,22T of CO₂

Biogas treatment & Upgrade Technologies

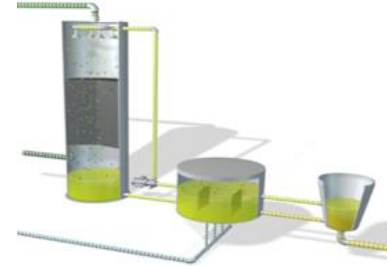
Industrial, Municipal or Agricultural

Desulfurization

Sulfide rich biogas
upgrade for direct
application



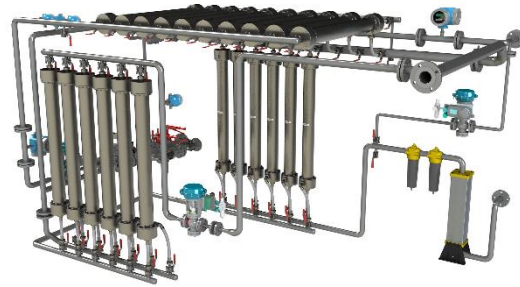
NaOH SCRUBBER
(H₂S rem. in Biogas, < 30 kgS/d)



SULFOTHANE™
(H₂S rem. in Biogas, > 30 kgS/d)

Purification & Decarbonization

Biogas upgrade for
Biomethane
production



MemGas™
(Biogas upgrade)

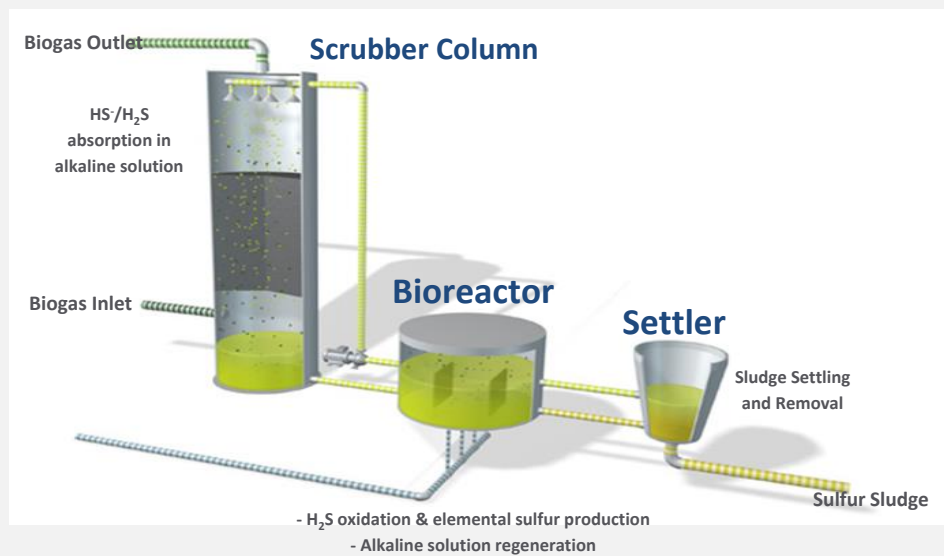
SULFOTHANE™

Biological H₂S removal



Process outline:

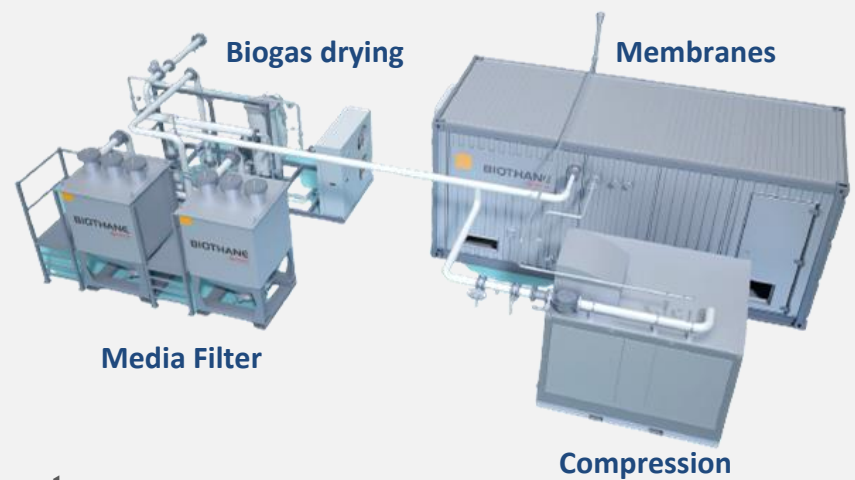
- 6 x 12.700 m³ digesters
- Biogas flow: 1,050 Nm³/h
- H₂S design load: 174 kg/d
- H₂S in: 5,000 ppm
- H₂S out: 100 ppm
- H₂S out: < 50 ppm



Key features

- *3 - stage design for alkalinity recovery*
- *High treatment performance*
- *High tolerance to feed fluctuations*
- *Low chemical consumption*
- *Simple automatic control*
- *Easy to control & operate*
- *Packaged solution*
- *28 references worldwide*

MEMGAS™ Biogas Upgrading

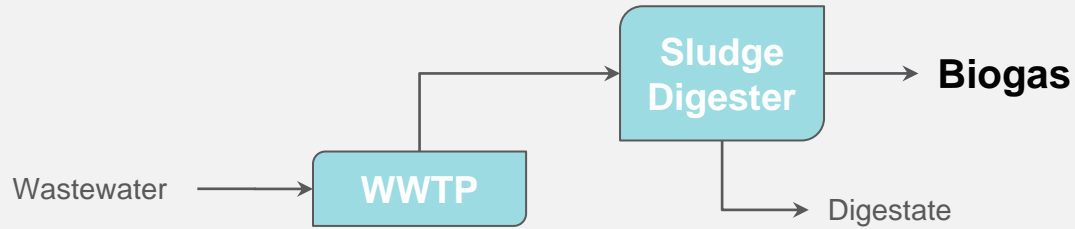


Key features

- *Low CH₄ loss (until < 0.5 %) => methane yield up to 99.5%*
- *Gas drying and compression is included in the process - direct injection possible*
- *Low energy consumption (< 0.3 – 0.4 kWh / Nm³ of raw biogas)*
- *Turn-key installation in compliance with Veolia safety standards including: HAZOP, ATEX, PED*
- *No consumables needed such as water or chemicals*
- *Start and Stop of the MemGas™ plant possible within few minutes*
- *High flexibility for fluctuation in biogas flow and composition*

CONTEXT

BENEFITS FOR MUNICIPALITIES



| REDUCTION OF SLUDGE VOLUME BY MIN.30%

| REVENUE FROM BIOMETHANE

| REDUCTION OF CARBON FOOTPRINT

By the combination of both sludge transport reduction and production of green energy

| CIRCULAR ECONOMY

The renewable gas is produced and used locally

CASE STUDY TOULOUSE (FR)

ENERGIBIO, The French largest
biomethane production from
WWTP



CLIENT

- Toulouse Municipality
- WWTP 950 000 PE
- Primary and secondary sludge

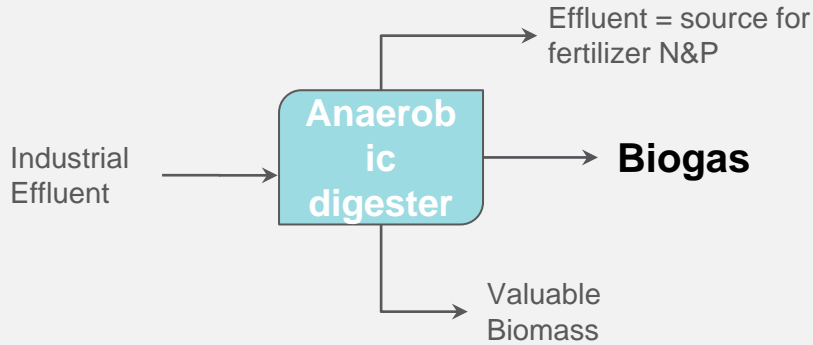


BENEFITS

- Average biomethane injection: 620 Nm³/h, equivalent to 33700 oil barrels per year
- Biomethane income: 60 M€ over 15 years (fixed feed-in tariff in France)
- Positive carbon balance over 15 years: 170 000 tCO₂ avoided

CONTEXT

BENEFITS FOR INDUSTRIES



| REDUCTION OF SLUDGE VOLUME

| REDUCTION OF ENERGY CONSUMPTION BY 10

| REDUCTION OF CARBON FOOTPRINT

By the combination of sludge production & energy consumption reduction, and production of green energy

| REVENUE FROM BIOMETHANE

The renewable gas is produced and used locally

CASE STUDY APTUNION (FR)

Candied Fruit Production



VEOLIA's SOLUTIONS

- Biobed® Advanced EGSB - anaerobic digestion 12 TCOD/day
- Sulfothane™- biogas biological desulfurization
- MemGas™ - biogas upgrading - 230 Nm³/h



BENEFITS

- 3 350 T COD treated
- 1 065 000 Nm³ biomethane
- 11,4 GWh green gas injected into the gas grid
- About 2 500 T CO₂ avoided
- 1,3 M€ of revenue thanks to biomethane

CONTEXT

BENEFITS FOR FARMERS & BIO-WASTE MANAGEMENT FACILITIES



| REDUCTION OF USE OF SYNTHETIC FERTILIZER

| REVENUE FROM BIOMETHANE

| REDUCTION OF CARBON FOOTPRINT

By the combination of both fertilizer reduction and production of green energy

| CIRCULAR ECONOMY

The renewable gas is produced and used locally, the digestate is landsread

CASE STUDY

MONTBRISON (FR)

CVE, Waste-To-Energy Project

MemGas™ - biogas upgrading - 350 Nm³/h



CLIENT

- Valorization of local organic waste into renewable energy
- By 2025, CVE plans to produce 6 TWh of biomethane injected into the gas grid, i.e. the energy recovery of 700 000 tonnes of organic matter



KEY FIGURES

- 25 000 T of organic wastes
- 2 080 500 Nm³ biomethane
- 22,2 GWh green gas injected into the gas grid
- About 10 000 T CO₂ avoided
- Total biogas plant CAPEX = 12,7 M€
- 3 to 4 FTE on site for operation

HOW IT IS IN YOUR NEIGHBORHOOD

Prague (CZ)

The client:

Prague Municipality - Municipal WWTP with primary and secondary sludge digestion

Objectives of the project:

- DEMO Plant for biomethane market boost in CZ
- Full biogas production (1500 Nm³/h) treatment in the future

BIOTHANE solution:

- MemGas™ able to treat 250 Nm³/h of biogas

Key figures :

- 1 290 000 Nm³ biomethane
- 14,2 GWh green gas injected into the gas grid
 - equivalent to 3560 households or 57 buses
- About 2 130 T CO₂ avoided



Good Practices in France



BIOMETHANE IN FRANCE

CHALLENGES



On average, the implementation of a biomethane project requires 3 to 5 years (situation before application in 2023 of the law relating to the acceleration of the production of renewable energies).



CHALLENGES

Regulatory frame

Incentives on producers side

Incentives on consumers side

Acceptability of projects



SOLUTIONS IN FRANCE

November 2011 : Decree setting the conditions for the purchase and injection of biomethane

- Subsidies on the CAPEX of projects
- 40% of the costs of connection to the gas network are covered by the French Government
- Standardization, transparency & non-discrimination of access to the gas network

- Attractive biomethane feed-in tariff
- Obligation of green gas consumption quotas
- System of tax exemptions for certain industries
- Subsidies for investment in a fleet of NGV vehicles

[ADEME](#) Guide
Communication :

- Circular economy,
- Creation of local jobs,
- Positive externalities of biogas plants and biomethane

Q&A

