BIOTHANE
Complete range of solutions for industrial wastewater treatment with anaerobic at the heart

WATER TECHNOLOGIES

- Online control
- Biogas Manager
- Control® SMART
- Membrane
- Biogas DUO
- Anaerobic granular sludge
- Biobed
- Thionium
- Anaerobic granular sludge
- Biobed Advanced EGSB
- Anaerobic granular sludge
- Bioblock Contact
- Anaerobic digester
- Upthane
- Municipal UASB
- Membrane
- Anaerobic MBR
- Sulfothane
- Biological N2S scrubber
- Biogas upgrade
- Electricity production
- Memgas
- Gas to grid
- Pre-treatment
- Idraflot DAF
- Dissolved Air Flotation
- Multiflow
- Enhanced clarification and lamella settling
- Nutrient removal & recovery
- Anaerobic Anammox
- AnoxK Max
- Anammox oxidation
- Struvite production
- Reverse osmosis
- Water reuse
- Post-treatment
- MBBR
- Moving Bed Biofilm Reactor
- Bioaerop
- Aerobic MBR
- Hydrotech Discfilter
- Effluent filtration

BIOTHANE
Resourcing the world

VEOLIA
Biomethane: Potential Applications

- Industrial wastewater
- Municipal sludge
- Organic waste (agriculture, food waste, etc.)

Anaerobic Technology

→ Raw Biogas

- Treated water
- Photo bioreactor

Digestate: fertilizers, compost...

Biogas boiler

Heat 85% efficiency

CHP

- Heat 40% efficiency
- Electricity 38% efficiency

Biogas upgrading

Biomethane 98% efficiency

- Offgas CO2
- Natural gas grid
- Biomethane fuel station
Multi-stages Membranes

Overall energy consumption at design condition **0.3 – 0.4 kWh/Nm³** biogas

- **Raw biogas**: CH₄, CO₂, N₂, O₂
- **Compression (10 - 20 bars)**
- **Off-gas CO₂ > 99%**
- **Biomethane CH₄ > 97%**

**Strengths:**
- No heat demand
- No liquid discharge
- Biomethane already compressed

**Weaknesses:**
- Reliable pre-treatment
- Biomethane quality depends on N₂ in biogas
- Min CH₄ in off-gas 0.5 %
Other technologies: Water scrubber, Amine Washing, PSA

- **Strengths:**
  - Low heat demand
  - Can work without pretreatment

- **Weaknesses:**
  - High water demand
  - High polluted water discharge
  - Compression of biomethane according to the end use

- **Strengths:**
  - High methane recovery rate

- **Weaknesses:**
  - Amine discharge cost
  - High heat demand for regeneration
  - Compression of biomethane necessary

- **Strengths:**
  - Adapted to high flowrate
  - No liquid discharge
  - Low heat demand

- **Weaknesses:**
  - Reliable pre-treatment
  - Irreversible damage in case of H₂S
  - Compression of biomethane according to end use
CAPEX and OPEX comparison

Biogas upgrading plant 280 Nm\(^3\)/h - Operation time 8,200 h/year

Source: Aquantis feasibility study (2012)
Energy cost comparison

Biogas upgrading plant 280 Nm³/h - Operation time 8 200 h/year

Source: Aquantis feasibility study (2012)
2. Case Study 1 - Municipal Project
Treatment Process - Veolia Line

- Primary and biological sludge
- Centrifuge
- Thermal hydrolysis Biothelys™
- Digesters volume: 2 x 5 700 m³
- Biogas treatment flowrate: 1 500 Nm³/h
- Digestion returns: 710 m³/day
- Biogas CH₄ content: 65 to 70 %
- %VM: 83 %
- WWTP capacity: 950 000 PE
- Sludge quantity: 20 000 TDS/y
- Biomethane into gas grid
- Incineration
- MemGas™
- Sulfothane™
- Gasholder
- Digestion returns treatment Anitamox™
- Back to the water treatment line

Thermal hydrolysis flowrate: 180 m³/day
Main Advantages of the combination of VEOLIA technologies

- **Biothelys™:**
  - 60% of digesters volume
  - 51% of DS content of sludge
  - +14% of biogas production

- **Anitamox™:**
  - 60% of electrical consumption for nitrogen removal compared to conventional treatment

- **Sulfothane™:**
  - 80% of OPEX compared to caustic scrubber or activated carbon treatment

- **MemGas™:**
  - 99.5% of efficiency
• Digested sludge quantity: 8 000 TDS/year

• 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

Return on Investment : 12 years
3. Case Study 2 - *Industrial Project*
Treatment Process

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<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tr>
<td>Flow</td>
<td>800 - 1600 m³/day</td>
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<tr>
<td>COD</td>
<td>11 300 mg/L (12.7 tpd)</td>
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<tr>
<td>TSS</td>
<td>480 mg/L</td>
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<tr>
<td>pH</td>
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</tbody>
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**SCOD removal rate:** > 85%

H₂S < 100 ppm

99.5% efficiency @ 190 Nm³/h

Biomethane into gas grid
Key Figures

- Sludge quantity: 1800 T/year
- Average biomethane injection: 825 000 Nm$^3$/year
- Biomethane income: 18 M€ over 15 years (fixed feed-in tariff in France)

Return on Investment < 4 years
MemGas™
the ultimate valorisation of biogas to biomethane