

Solutions for Clean Water & Green Energy



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Foreword

Industries around the world are contributing towards economic growth and prosperity by creating jobs and by making sophisticated products accessible to ever more people in existing and new markets.

However, rising energy prices and environmental awareness and regulations significantly raise costs for the industries, potentially limiting future growth.

Global Water Engineering (GWE), formerly known as Enviroasia, offers state of the art technology solutions to the industry with regard to clean water and green energy and as such assists industries around the world to sustainably grow their business while drastically diminishing energy costs and simultaneously reducing their carbon footprint.

Our team of experts comprises most of the pioneers that have been developing modern anaerobic wastewater and biomass treatment over the past 30 years.

These top of the line anaerobic treatment technologies are complemented with extensive experience in aerobic treatment processes for BOD and nitrogen removal.

With over 300 satisfied customers around the world, our company has grown to be a world leader in anaerobic wastewater treatment and biomass-to-energy solutions for a wide range of industries.

Our Mission:

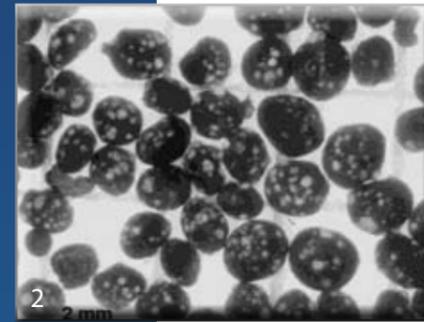
GWE aims to remain a reliable supplier of environmental and wastewater treatment technology, of international standard, adapted to the local situation, and at affordable prices. GWE supplies practical and modern technologies, "best buy" solutions that consistently meet all guarantees and enhance performance.

Our Vision:

GWE commits to creating cost-effective solutions that allow industries around the world a greener footprint and maximised energy-efficiency. As such, GWE contributes to a better and cleaner world for current and future generations.



Jean Pierre Ombregt
Chairman & CEO



- 1 Engineering, procurement and construction of complete clean water and green energy solutions
- 2 Continuous R&D efforts for optimized knowledge on anaerobic processes and bacteria
- 3 PLC/SCADA Control for reliable plant operation and easy control

Scope of Activities

Our know-how and services cover a wide spectrum of environmental solutions such as wastewater treatment, renewable energy, biogas utilization for fossil fuel replacement and green power production, Kyoto carbon emission reductions, biofuels, biomass, biowaste, sludge digestion, and water recycling.

At GWE we strive to be a long-term partner for our clients and our strategic business partners around the world.

Therefore we offer a broad and integrated range of activities and expertise within our field of knowledge. All these can be flexibly combined to suite the customer's specific requirements, with GWE always taking full responsibility for project management, quality, price and time schedule.

- **Research & Development** - Via extended R&D efforts and collaborations with renowned universities GWE aims to keep its leading position on anaerobic wastewater and biomass solutions
- **Feasibility Studies, Lab & Pilot Testing** - GWE helps its customers maintain their competitive advantage by assisting them with the objective assessment of the best available technology.
- **Process Design** - From the design stage onwards, we work together with the customers, always keeping a close eye on their specific requirements for optimal treatment of their specific wastewater or bio-waste.
- **Engineering, Equipment Supply, Start-up & Commissioning** - GWE, through its extensive global network, can successfully deliver a package consisting of all engineering, project management and construction site services, as well as part or all electro-mechanical equipment and materials. Also a complete plant can be delivered, including local mounting, piping, cabling and civil works.
- **After Sales** - Through our dedicated team of wastewater specialists, located throughout Europe, Asia, Africa, North- and South America, we have a tradition of in-depth technical communication with the customers. This enables us to keep our research efforts in tune with market needs.
- **Operation & Maintenance** - To maximize ongoing plant performance, GWE provides multiple levels of O&M services, ranging from process assistance and operator training via annual audits or continuous remote plant monitoring to full-scale O&M contracts.



CLNSA Alcohol Distillery, Nicaragua: FLOTAMET™ Anaerobic WWTP with steel reactors – 102,100 kg/d COD

Markets Served

GWE's technologies serve a wide range of industries typically with high-strength effluents. Being the major pioneer in anaerobic wastewater technologies, treatment of such 'difficult' effluents finds its origin with GWE's key-engineers and dates back as far as the early seventies. It gave GWE a head start and leading position in this specialist market with currently well over 5 million kg COD/day being treated by GWE installations worldwide.

BEER & BEVERAGES

GWE reactors worldwide are currently treating a total of more than 1 million kg COD/day for the most renowned companies in the Beer & Beverages Industry.

Anaerobic treatment has developed in recent years as the wastewater treatment technique of choice for breweries.

Many soft drink and non carbonated beverage (tea, coffee- and milk-based drinks and fruit juices) bottling and canning plants have increasingly been choosing anaerobic treatment for their wastewater.

FOOD PROCESSING & CANNING INDUSTRY

The processing and canning of fruits, vegetables, meat, fish and seafood produces medium to high strength wastewater with ideal characteristics for anaerobic digestion. GWE has a unique variety of methane reactors, specifically designed to deal with the particular aspects of these effluents such as high levels of suspended solids, fats, oil and grease, proteins, ammonia, etc.

SNACKS, CONFECTIONARY, DAIRY

These industries produce effluents in a wide range of quantities and strengths. Most of them are suitable for anaerobic digestion. GWE has numerous successful references in this industry.

AGRO AND AGRO-PROCESSING INDUSTRIES

A large number of agro-industrial effluents are highly suitable for anaerobic digestion. Amongst them are the beet sugar industry, starch industry and palm oil processing industries and recently also the biodiesel industry.

The further processing of basic products of this agricultural industry produces medium- to high-strength organic effluents, usually also highly suitable for anaerobic digestion.



Prominent amongst those is the starch processing industry with production of sweeteners and modified starches from tapioca, corn and wheat starch. More than 1.5 million kg COD/day is treated by GWE installations in this industry worldwide.

FERMENTATION INDUSTRY

This is a particular agro-processing industry, characterized by very high strength effluents (up to 150,000 mg/l COD and higher). The preferred feedstock is molasses, although all kinds of starch materials can be used. This industry produces a variety of end products such as alcohol (bioethanol), baker's yeast, fodder yeast, citric acid, monosodium glutamate, some pharmaceuticals, amino acids etc.

PULP & PAPER

A major successful application in this industry is the anaerobic treatment of the effluents from recycled paper factories. GWE has built award-winning plants for this application such as for Visy Paper in Australia, where our ANUBIX™-B anaerobic reactor treats 12,000 kg COD/day. GWE has also been awarded the contract for the world's most advanced wastewater treatment plant for paper mill effluent by Vinakraft Paper in Vietnam, using a sophisticated 5-stage treatment treating 60,000 kg COD/day to get the COD concentration down to maximum 40 mg/l.

PETROCHEMICAL INDUSTRIES

Selected petrochemical industry effluents are also suitable for anaerobic digestion. For example PTA, PET, glycol and polyester factories have suitable effluents with which GWE has positive practical experience.

BIOWASTE TO ENERGY & ENERGY CROPS

Besides wastewater, also a wide variety of biowaste can be turned into renewable energy with GWE's dedicated anaerobic treatment technologies:

- Amongst them are pulp & peels from tapioca, potato and fruit processing
- Slurries from the food industry, slaughterhouses and DAF sludge
- Animal manure.

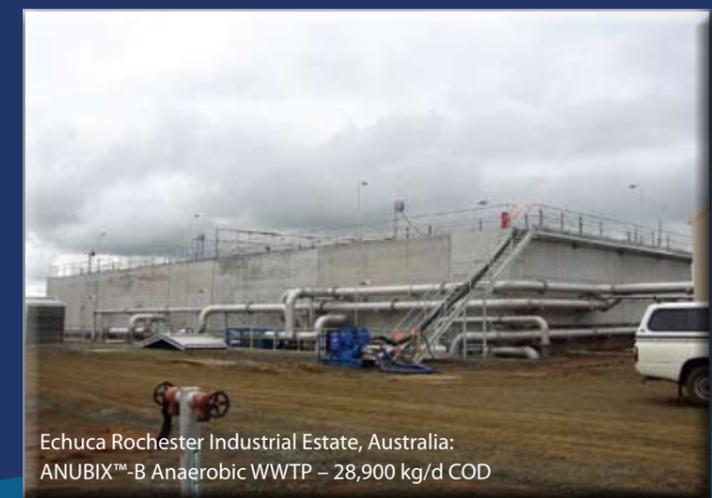
Additionally, energy crops such as non-food corn and various grasses (Sudan Grass and Sweet Sorghum) can successfully be turned into a renewable source of energy with GWE's solutions.



DEKO Foods, Hungary: ANUBIX™-C Anaerobic WWTP – 24,000 kg/d COD



Corn Products Amardass, Thailand: ANUBIX™-B Anaerobic WWTP – 150,000 kg/d COD



Echuca Rochester Industrial Estate, Australia: ANUBIX™-B Anaerobic WWTP – 28,900 kg/d COD

Clean Water for the Industry

SPECIALISTS IN TREATING WASTEWATER WITH HIGH ORGANIC POLLUTION

GWE's main expertise lies in the biological treatment of medium- and high-loaded organic wastewater by anaerobic processes.

For anaerobic wastewater treatment, GWE is one of the world market leaders with its team of experts comprising most pioneers of modern anaerobic wastewater treatment.

ANAEROBIC WASTEWATER TREATMENT

GWE's anaerobic wastewater treatment technologies use bacteria to digest the organic matter (Chemical Oxygen Demand or COD) in the wastewater. The technology is called anaerobic because these bacteria don't require oxygen.

Through anaerobic digestion, GWE technologies can remove up to 98% of organic pollution (COD) from the wastewater, making it suitable to be discharged in surface waters. If necessary, for specific applications, the remaining pollution can be further treated by one of our complementing aerobic treatment systems.

GWE's 7 proprietary anaerobic reactor types offer a truly unique range, each specifically designed for dedicated organic loads.

Our main anaerobic reactor family, the ANUBIX™-series, is based on the Up-flow Anaerobic Sludge Blanket (UASB)-technology and is available in 3 different designs:

- ANUBIX™-B: for low to medium strength wastewaters with moderate TSS and no FOG
- ANUBIX™-C: for medium to high strength wastewaters with higher TSS and some FOG
- ANUBIX™-T: a tower-shaped EGSB (Expanded Granular Sludge Bed) for low to medium strength wastewater with low TSS and with strict space limitations.

When UASB-solutions are not sufficient such as for salty wastewaters, and water containing lots of fat, oil and grease (FOG) or nasty chemicals that induce flotation in the UASB-reactor, GWE has designed several additional anaerobic reactor types, offering dedicated solutions for the specific problems.

1 New Belgium Brewery, USA:
ANUBIX™-B Anaerobic WWTP –
10,000 kg/d COD

2 Baltika Samara Brewery, Russia:
ANUBIX™-B Anaerobic WWTP –
10,000 kg/d COD

3 Odwalla Fruit Juices, USA:
ANUBIX™-B Anaerobic WWTP –
4,700 kg/d COD

4 Kaiser Brewery, Brazil: ANUBIX™-B
Anaerobic WWTP – 16,500 kg/d COD

5 ChockYuenYong Starch Factory,
Thailand: ANUBIX™-B Anaerobic
WWTP – 72,000 kg/d COD



GWE's FLOTAMET™ or **FLOTation METHane** reactor has additional mechanical mixing incorporated and a separate Dissolved Biogas Flotation (DBF) module. It is highly suitable to treat FOG-rich and salty wastewater as well as wastewater containing a lot of proteins or fibers.

The ANAFIX™, **ANAerobic Filter** reactor contains a plastic biomass carrier material throughout the reactor creating an optimal environment for treating wastewaters from the chemical industry and containing a low amount of suspended solids.

Another proprietary reactor type is the ANAMIX™ **ANAerobic MIXed** digester. Good mechanical mixing allows better treatment of concentrated wastewater as well as sludge and slurries with high FOG concentrations.

All our above anaerobic solutions combine the advantages of maximum COD to biogas conversion combined with low operating costs, low excess sludge production, low space requirements and a good resistance to variable wastewater loads and concentrations.

The COHRAL™ is a basic **CO**vered **H**igh **R**ate **ANAerobic L**agoon using high quality UV-resistant materials. It is a less process-efficient installation in terms of loading rate, but can sometimes offer a solution for less technology-demanding applications that allow a long residence time and where plenty of space is available.

BIOGAS UTILIZATION FROM WASTEWATER TREATMENT FOR FOSSIL FUEL REPLACEMENT AND GREEN POWER PRODUCTION

One of the major advantages of anaerobic wastewater treatment is the controlled continuous production of valuable biogas.

The closed anaerobic process systems prevent large quantities of CH₄ (an important greenhouse gas) to be emitted in the atmosphere. With CH₄ being 21 times more harmful to the atmosphere than CO₂, GWE's anaerobic wastewater solutions clearly qualify for Emission Reduction Certificates under the United Nations Kyoto Clean Development Mechanism (CDM) and the Joint Implementation (JI) program.

Additionally, our solutions can also diminish or even completely

- 1 Coca Cola Xian, P.R. China: ANUBIX™-B Anaerobic WWTP – 9,000 kg/d COD
- 2 Visy Paper, Australia: ANUBIX™-B Anaerobic WWTP – 12,000 kg/d COD
- 3 Warka Brewery, Poland: ANUBIX™-B Anaerobic WWTP – 10,000 kg/d COD



Bavaria Brewery, Columbia: ANUBIX™-B Anaerobic WWTP with activated sludge aerobic treatment – 21,000 kg/d COD



- 1 SAB Miller, USA: Ground flare and biogas scrubber at anaerobic WWTP – 29,400 kg/d COD
- 2 Xing Feng Landfill, P.R. China: ANUBIX™-B Anaerobic WWTP – 14,100 kg/d COD
- 3 Coca Cola, Changsha, P.R. China: ANUBIX™-B Anaerobic WWTP with activated sludge aerobic treatment – 3,400 kg/d COD
- 4 SAB Breweries Newlands, Cape Town South Africa: Covers for odor control – 18,000 kg/d COD
- 5 Beer Thai Kamphaeng Phet, Thailand: Biofilter odor control at anaerobic WWTP – 82,500 kg/d COD
- 6 Anaerobic versus aerobic wastewater treatment

replace the use of fossil fuels in the production process. For specific industry applications with high organic loads, enough biogas can be generated to fully cover a factory's energy needs and still have a biogas surplus to feed it into power generators and sell to the national grid.

For the handling of the biogas GWE offers proprietary SULFURIX™ desulphurization, GASODRIX™ biogas drying and CALORIX™ biogas-fired direct influent heating technologies.

GWE also has its own range of flare systems and dual fuel burner systems through its wholly-owned subsidiary DWS in Antwerp, Belgium.

AEROBIC WASTEWATER TREATMENT

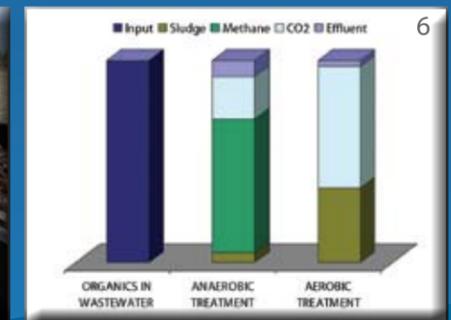
Our top of the line anaerobic treatment technologies are complemented with extensive experience in aerobic treatment processes for the further removal of organic pollutants and nitrogen (nitrification, denitrification).

To remove the organic load in the wastewater, this method uses bacteria that require large amounts of oxygen. The high demand of oxygen requires the wastewater to be aerated constantly, therefore making this a far less energy-efficient wastewater treatment solution than anaerobic treatment.

Although less efficient such further treatment can be necessary as a final polishing step to achieve a stringent effluent quality, required for specific applications such as discharge in surface waters or water reuse.

GWE's range of aerobic water treatment technologies includes :

- ACTIVOX™ Activated Sludge solutions
- ASTEROX™ Nitrogen and Phosphor removal technology,
- SEQUOX™/CYCLOX™ a Sequencing/Continuous Batch Reactor
- MEMBROX™ Membrane Filtration solutions.



OTHER WASTEWATER TREATMENT SOLUTIONS

Although GWE's focus is primarily on anaerobic and aerobic wastewater treatment, we also supply equipment for sludge treatment, mechanical wastewater treatment, physico-chemical wastewater treatment, process water & water reuse.

By adding this equipment our wastewater treatment installations are complete wastewater solutions, specifically designed for each customer's specific requirements and budget.

UNIQUE VERSATILITY FOR BEST-QUALITY GUARANTEES

We are extremely proud to the fact that, to date, all our worldwide reference plants show a 100% track record of meeting and exceeding its performance guarantees.

Seeing the extreme variety in industrial wastewater composition we see this as a unique achievement, almost unprecedented by any other company in our sector.

An important aspect in achieving this result is our versatile and extended range of dedicated anaerobic reactors, each designed for handling a specific job.

It avoids plant capacities being under-designed and ensures maximum efficiency in biogas production.

For each individual case we select the best reactor type for the specific wastewater characteristics.

This is truly unique in the market and goes far beyond the typically very broad range of COD compiled in one reactor design.

Green Energy for the Industry

FROM BIO-WASTE TO POWER

With our RAPTOR® technology, green energy can be produced out of wet industrial and agricultural organic residues such as vegetable and fruit processing waste, meat and fish processing waste, tapioca and sugar beet pulp, potato waste, paper mill waste, suitable energy crops and the organic fraction of municipal solid waste (OFMSW).

RAPTOR® stands for RAPid Transformation of Organic Residues. It is a novel and powerful process that converts organic "bio-waste" into biogas in much less time than conventional systems. The biogas can be used in factory steam boilers or can be treated with proprietary GWE systems for sulphur and moist removal, prior to electricity and heat production in stand-alone Combined Heat & Power (CHP) units. The RAPTOR® system is a 3-step treatment with a substrate adapted enzymatic and/or mechanical "pulping" pre-treatment, followed by a high temperature acid fermentation and ultimately a high rate anaerobic digestion step. Conversion efficiency of "ideal" substrates exceeds 90%.

Depending on the specific substrate or substrate mix, several variations of the RAPTOR® process are available, to adapt the base process to individual cases. Nitrogen and Phosphorous capturing treatment can be added as needed. Depending on intake and residue logistics, peripheral units like silage bunkers and storage tanks, or dewatering centrifuges and presses can be added. A RAPTOR® plant can also ideally be combined with an existing wastewater treatment installation. Sludge from such a plant is treated in the RAPTOR® system, whereas the usually small amount of liquid effluent from the RAPTOR® plant is treated in the wastewater treatment system.

After treatment through the RAPTOR® process the original amount of bio-waste is reduced to an up to 10 times smaller volume of stable and hygienised wet "cake". This interesting by-product is an excellent bio-fertiliser. In the case of big plants and appealing local market opportunities, it can be dried, pelletized and commercialised.

FROM BIO-SLUDGE TO POWER

In conventional sludge digestion systems like our ANAMIX™ digester, the conversion efficiency and biogas yield is often low when treating organic liquid wastes like surplus sludge from biological wastewater treatment plants. With our THEAREX® process we are pushing a conventional treatment system to extreme performance limits by adding a chemical or mechanical "cracking" pre-treatment. This greatly increases the biogas production and reduces the non-digestible residue to be disposed off.

THEAREX® stands for THERmophilic Anamix Reactor EXtreme. Depending on the case, the "cracking" pre-treatment to increase the biogas yield is done by chemical or microbial hydrolysis and/or by physical disintegration. In order to increase the biogas production speed as well, the digester is preceded by a microbial hydrolysis step operated at a high temperature (thermophilic 55°C) and followed by a mesophilic or thermophilic methanogenic step.



GWE solutions are Carbon Credit Eligible



The Kyoto Protocol is an international agreement that provides financial incentives for the reduction of greenhouse gas emissions from eligible investment projects in countries that have ratified the Protocol under various schemes such as Clean Development Mechanism (CDM) and Joint Implementation (JI).

Under the Kyoto Protocol, projects which qualify for Emission Reductions are awarded yearly certificates for each ton of greenhouse gases (CO₂, CH₄ and N₂O as the most important ones) they prevent from entering the atmosphere. There now also exists an active Voluntary Emission Reduction Program, supported by environmentally conscious corporates, trying to offset their carbon footprint.

The advantages of GWE's anaerobic wastewater and bio-waste solutions are 4-fold.

- 1 Using our anaerobic wastewater treatment technologies avoids CH₄ being released in the atmosphere in case open lagoons were used before. This directly qualifies for Emission Reductions (ERs) certificates under the Kyoto protocol.
- 2 Using our anaerobic technologies results in replacement (shutdown or non-construction) of power consuming and sludge producing aerobic WWTPs.
- 3 Our anaerobic reactors require minimal power consumption and generate valuable biogas (CH₄) which can be used to generate steam or electricity. This way, industries' production processes can be partially or completely powered by steam or electricity from the biogas, replacing ever more costly fossil fuels and generating further emission reductions.
- 4 For specific applications there's even enough surplus biogas to produce electricity, through power generators, that can be sold to the electricity grid generating even more ERs.

GWE's unmatched biogas production and COD removal guarantees are directly correlated to the maximization of expected validated ERs for each of our projects.

As such, GWE's solutions offer substantial additional revenue from ERs and fossil fuel replacement, paying back your wastewater treatment in a minimal amount of time.

GWE is specialized in this field and together with our extensive partner network we are able to offer our clients full services to help their project benefit from the Kyoto Emission Reductions program, including financing and BOT schemes.

Global Presence

Global Water Engineering is a group of companies that operates globally through local offices in Belgium, Germany, Hong Kong, India, Philippines, Thailand & USA and with an extended network of qualified local partners in more than 20 countries.



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