Welcome to the IBA

Dear Industry Colleague:

Welcome to the Integrated Biogas Alliance. As President of the IBA and on behalf of our members and partners, I am pleased to present our Statement of Qualifications which you will find summarizes the collective technology, services, expertise and references from 11 of the industry's top technology innovators, subject matter experts and execution specialists.

The IBA is a unique, fully integrated organic waste to renewable energy platform solution that de-risks biogas projects for developers, owner/investors and builders, improving their bankability and providing economic, agronomic and environmental advantages for biogas projects around the world. The IBA is a non-exclusive confederation of internationally recognized technology and related services companies with a combined tenure of over 275 years in the organics diversion and treatment and/or renewable natural gas industry. We have a long track record of combined success, having deployed close to 4000 biogas related systems and projects on 6 continents and in 55 countries. Along with significant global deployment capability, all our members and partners have long standing reputations for quality execution, operational excellence and customer satisfaction.

With our global footprint, reach and supply chain, the IBA has the capability to process virtually any organic waste including agricultural residues, livestock, food and green waste, generating both renewable natural gas for pipeline injection, CNG or CHP, as well as compost and other organic fertilizers. Additionally, we can process/treat raw municipal solid waste, separating out inorganics that can be repurposed as RDF/SRF for industrials that needs a renewable fuel option.

The market is pulling all industry stakeholders towards providing customers with a more integrated technology solution which also includes integrated system process guarantees that EPCs require and provide greater surety for the owner's investment, driving stronger ROI performance, long-term economic viability and enabling more circular economy benefits.

A final word on the need to accelerate the global deployment of organic waste to renewable natural gas projects...the IBA supports and endorses the World Biogas Association's position (Global Potential of Biogas - 2019) that the biogas sector has the potential to deliver up to a 12% reduction of global greenhouse gas (GHG) emissions. We also agree with the report that digestate from biogas plants could substitute 5-7% of all global inorganic commercial fertilizer requirements. We believe that the IBA integrated platform model has the ability to help in this acceleration by not only de-risking projects for owners and builders but by accelerating the deployment of reference plants that will instill more confidence in the renewable infrastructure investment community.

We look forward to advancing discussions with you regarding your biogas project and welcome any questions you may have.

Sincerely,

Christopher D. Maloney
President
Integrated Biogas Alliance
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Vision

Become a global market leader providing fully-integrated biogas solutions for any organic waste stream

- De-risk projects for financing and implementation
- Optimize project design and minimize costs
- Decrease cycle time to revenue
- Improve operating performance and ROI
- Deploy world-class reference plants around the world

Platform Solution
Value Proposition

- Industry leading companies with over 275 years of combined experience
- Proven technologies with strong history of competing in global markets
- Fully integrated platform solution for any agricultural or biowaste feedstock
- Operational offices on 4 continents in 41 locations
- Global supply chain to deploy anywhere in the world
- Key industry partnerships provide turnkey execution and financing
- Lowers risk for owner/investors and EPCs
- Single design and installation package
- Optimizes the economic, agronomic and environmental value of the organic waste
- Integrated performance guarantees
- Integrated service offering
4299 Projects | 6 Continents | 68 Countries

Global Deployment

Africa
- Cape Verde
- Egypt
- Kenya
- Morocco
- Rwanda
- South Africa
- Tanzania

Asia
- China
- India
- Indonesia
- Iran-Kurdistan
- Japan
- Myanmar
- Phillipines
- Russia
- Singapore
- South Korea
- Thailand
- Turkey
- Vietnam

Europe
- Austria
- Belgium
- Bosnia and Herzegovina
- Bulgaria
- Croazia
- Cyprus
- Czech Republic
- Denmark
- England
- Estonia
- Faroe Islands
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- Italy
- La Reunion
- Latvia
- Macedonia
- Netherlands
- Norway
- Poland
- Romania
- Scotland

North America
- Canada
- Guadalupe
- Guatemala
- Mexico
- USA

South America
- Argentina
- Brazil
- Chile
- Ecuador
- Peru
- Uruguay

Oceania
- Australia
- Cook Islands
- New Zealand
Zenviro Tech is a globally recognized technology supplier in the field of environmental technology with over 100 biogas plants installed worldwide. We develop not only biogas plants but also plants for exhaust air treatment, wastewater treatment, water treatment, waste disposal and weapons destruction.

In November 2020, Zenviro Tech acquired Eisenmann’s U.S. Environmental Technology business unit including all of its key management and biogas subject matter expertise.

Extracting Value From Organic Waste: Anaerobic Digestion & Biogas Production

Anaerobic digestion is an effective way to increase the value of yard and food waste. Converting organic waste to biogas, which can be upgraded and used as fuel for your truck fleet or fed into the natural gas pipeline, provides economical and environmental benefits for municipalities and waste management companies. The separated digestate can be composted or converted into other fertilizing products. The options with anaerobic digestions and biogas production provide a lot of flexibility for the future of renewable energy. We have been active on the biogas market since 2003 and since that time have built more than 100 plants worldwide.

Office Locations

Zenviro Tech is proud to operate in North America, Europe and Asia. Our team has developed projects all over the world and is still growing and looking for new, exciting opportunities.

- Chicago, Illinois, USA
- Mexico City, Mexico
- Milan, Italy
- Hyderabad, India
- Shanghai, China
Technology

The central technology of the Zenviro Tech Organics Diversion Platform is the Horizontal Plug-Flow Semi-Dry Anaerobic Digester. This design delivers the best digestion results and reliable operation for difficult organic substrate applications, supporting high organic loading rates and high solids content. The horizontal plug-flow (HPF) digester provides the ideal microbiological conditions for efficient conversion of organic materials into biogas. The design maximizes microbial contact with the feedstock and ensures a high gas yield and dependable, uninterrupted operation. Zenviro Tech’s solution ensures sufficient residence time for full methane conversion & sanitization of the feedstock.

Robust systems are in place to ensure effective plant safety across all operation. Steam heat maintains precise, even temperatures. An industrial-standard control system, in conjunction with continuous monitoring and logging of all relevant process parameters, enables fully automated operation and exceptional reliability.

With the plug-flow process, it is not necessary to dilute high-solid feedstocks, reducing digestate volumes, allowing for the design of organics processing facilities to be compact. HPF digesters are modular and can be laid out efficiently for future expansion. Zenviro Tech digesters are made from either prefabricated concrete panels or can be cast in place. The vessel has a rectangular cross-section, which means they are fully and easily accessible to inspectors. For this purpose, digesters are fitted with large pressure-tight doors.

Some of the other benefits included in an Zenviro Tech plug-flow digester are:

- The roof of the digester generally comprises a removable double membrane gas-level indicator for controlling the flow to downstream equipment. Fully enclosing the system ensures completely safe biogas production and handling. Alternatively, digesters can be constructed with concrete roofs.

- An industrial-standard control system, in conjunction with continuous monitoring and logging of all relevant process parameters, enable fully automated operation with exceptional reliability.

- Comprehensive safety systems in accordance with applicable local legislation and standards ensure that the plant functions safely in all operating modes.

Services Portfolio

Zenviro Tech offers a broad portfolio of services that are tailored to customers specific requirements, taking into account existing in-house skills, cost structures, and their need for specialist support. We believe in building a true partnership, driven by customer imperatives.

Just a few of the services that Zenviro Tech can provide are:

- Inspection
- Maintenance
- Repairs
- Remote diagnosis
- Stand-by support
- Maintenance contracts
- Full-service solutions
CR&R serves more than 2.5 million people and 25,000 businesses throughout Orange, Los Angeles, San Bernardino, Imperial, and Riverside counties. With a state-of-the-art recycling plant in place, CR&R reached out to Zenviro Tech to help develop and integrate a new anaerobic digestion plant into their existing operations. The system is permitted to process 80,000 tons/year per phase with Phase I and II currently in place and the potential for two more phases.

Feed provided for the system is collected curbside “green material” and food scraps from CR&R’s municipal waste collection. The combination of volatile food waste and bulky green waste required a robust, flexible system to ensure efficient biogas production. Zenviro Tech’s horizontal plug flow digesters were selected for this project for their ability to provide the greatest biogas yields across a broad range of feedstocks.

Biogas collected from the digesters and post digesters was sent to an upgrading unit that utilized water scrubbing to create a methane-rich gas that CR&R used to fuel their fleet of collection vehicles and any excess gas was piped into the pipeline distribution system.

### Technical Data CR&R Plant (Phase I and II)

<table>
<thead>
<tr>
<th>Feedstocks</th>
<th>Green Waste and Food Waste</th>
</tr>
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<tbody>
<tr>
<td>Throughput</td>
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<td>Digester Capacity</td>
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<td><strong>Digester:</strong></td>
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<tr>
<td>~ 370,000 gal</td>
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<td><strong>Post digester:</strong></td>
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<td>~ 630,000 gal</td>
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<tr>
<td>Biogas Flow Rate nom.</td>
<td>~ 1060 SCFM</td>
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<tr>
<td>Biogas Production</td>
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<td>Diesel Gallon Equivalent Production</td>
<td>~ 2,000,000 DGE/year</td>
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# Project References

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Year</th>
<th>Status</th>
<th>Substrates</th>
<th>Technical Data</th>
</tr>
</thead>
</table>
| Entsorga Italia SpA           | Santhia (VC), Italy     | 2019  | Under Construction | Biowaste                   | Main Digester: 1x 2000 m³  
                                  |                         |       |                 | Biogas Yield: 450 Nm³/h   | Biogas Yield: 8x 2000 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1,700 Nm³/h |
| HEEE Tu Quan                  | Inner Mongolia, China   | 2019  | Under Construction | Straw Manure                | Main Digester: 8x 2000 m³  
                                  |                         |       |                 | Biogas Yield: 1,700 Nm³/h  | Biogas Yield: 1,200 m³  
                                  |                         |       |                 |                             | Biogas Yield: 360 Nm³/h  |
| BioSairila                    | Mikkeli, Finland        | 2019  | Under Construction | Biowaste                   | Sanitation Unit: 1x 325 m³  
                                  |                         |       |                 |                             | Biogas Yield: 115 Nm³/h   |
| Harnosand Energi & Miljo      | Harnosand, Sweden       | 2018  | In Service      | Biowaste                    | Raising Throughput: 1x 325 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |
| Harnosand Energi & Miljo      | Harnosand, Sweden       | 2015  | In Service      | Biowaste                    | Main Digester: 1x 325 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |
| BGAC Energies SA              | Rances (VD), Switzerland| 2015  | In Service      | Agricultural residuals      | Main Digester: 1x 325 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 325 m³   |
| CR&R Phase II                 | Perris (CA), USA        | 2015  | In Service      | Biowaste                    | Main Digester: 1x 325 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 325 m³   |
| Gasversorgung Romanshorn AG   | Romanshorn, Switzerland | 2014  | In Service      | Biowaste                    | Biogas Upgrading: 20 Nm³/h  
                                  |                         |       |                 |                             | Biogas Upgrading: 20 Nm³/h |
| SAS                           | Schwerin, Germany       | 2014  | In Service      | Biowaste Green Waste        | Main Digester: 1x 1,100 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |
| Letizia                       | Caserta (CE), Italy     | 2014  | In Service      | Slurry                      | Main Digester: CHP: 400kW el.  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |
| CR&R Phase I                  | Perris (CA), USA        | 2013-14 | In Service | Biowaste Liquids            | Main Digester: CHP: 400kW el.  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |
| Reseau GDS                    | Strasbourg, France      | 2013-14 | In Service | Biogas Upgrading: 450 Nm³/h | Main Digester: 1x 175 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |
| Mostostal "WOD-KAN" Sp. Zo.o  | Biala Podlaska, Poland  | 2013-14 | In Service | OFMSW 20,000 t/a            | Main Digester: Final Storage Tank: CHP: 250kW el.  
                                  |                         |       |                 |                             | Biogas Yield: 2x 800 m³  
                                  |                         |       |                 |                             | Biogas Yield: 2x 1000 m³ |
| Kujalan Komposti Oy           | Lahti, Finland          | 2013  | In Service      | Biowaste Sludge Silica      | Main Digester: Biogas Upgrading: 4x 900 m³/h  
                                  |                         |       |                 |                             | Biogas Upgrading: 4x 900 m³/h |
| Falcognane                    | Roma (RM), Italy        | 2013  | In Service      | Silage Slurry Manure Olive Press Cake | Main Digester: CHP: 249kW el.  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |
| Bellicchi                     | San Secondo (PR), Italy | 2013  | In Service      | Silage Cattle Slurry         | Main Digester: CHP: 249kW el.  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |
| BioPower Nordwestschweiz AG   | Liestal (BL), Switzerland| 2012  | In Service      | Biogas Upgrading: 210 Nm³/h | Main Digester: CHP: 249kW el.  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |
| Sfondrini Soc. Agricola       | Lodi (LO), Italy        | 2012  | In Service      | Silage Slurry Manure         | Main Digester: CHP: 249kW el.  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |
| Fedeli Soc. Agricola          | Novara (NO), Italy      | 2012  | In Service      | Maize Silage Slurry Manure   | Main Digester: CHP: 249kW el.  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³  
                                  |                         |       |                 |                             | Biogas Yield: 1x 175 m³   |

*Additional references available upon request*
Greenlane: the global leader in biogas upgrading with 35+ years of experience, including 115+ installations in 18 countries, the first installation in 11 countries, and the largest biogas upgrading system in the world.

Globally, more RNG is being produced with Greenlane Biogas Upgrading Systems than with any other provider.

Also, as the only provider globally to offer all three primary biogas upgrading technologies including pressure swing adsorption (PSA), water wash, and membranes, only Greenlane provides:

- **unbiased technology comparisons** – providing complete confidence that you are using the best and most cost-effective technology for every project.
- **multiple technology solutions** – providing multiple technologies under a single performance, recovery and uptime guarantee, and
- **a single technology partner** – across every project, no matter which technology you need.

**What we do**

We offer complete, flange-to-flange process solutions to take raw digester or landfill gas, and compress it, treat it, and upgrade it for pipeline injection or vehicle fueling. We de-risk projects and maximize profitability for developers by ensuring optimum technology selection, complete process integration, and all-encompassing guarantees for gas quality, methane recovery and uptime.

In addition, we allow developers to significantly reduce upfront capital costs for their RNG project by offering flexible financing options including equity investment or “pay as you go” options.
Every Application

We live and breathe biogas upgrading – it’s all we do. We engineer, supply & service complete compression and treatment systems to turn any biogas source into high quality RNG for pipeline injection or vehicle fueling.

Every Technology

As the only provider with all three biogas upgrading technologies, only Greenlane offers an unbiased, multiple technology approach to product selection ensuring you get the best solution for every application, every time.
Global Experience & Support

Greenlane is headquartered in Vancouver, Canada with facilities in Sheffield, UK, and sales staff across North America and Europe for truly global coverage.

Greenlane North America:
3605 Gilmore Way, 110
Burnaby, BC V5G 4X5
Canada

+1 (604) 259-0343
Sales@GreenlaneBiogas.com

Greenlane Europe:
Unit 5 Chambers Way, Newton Chambers Road
Thorncliffe Park, Chapeltown, Sheffield S35 2PH
UK

+44 (0) 114 212 1301
Sales@GreenlaneBiogas.com

With guaranteed performance, methane recovery and uptime, you know your system will meet your gas quality specifications every time and all the time. We stand behind our upgrading solutions for the life of your project.
With more than 115 projects to choose from, and a long list of industry firsts, highlighting just one is difficult. But BFI's landfill gas to pipeline injection project in Montreal is not only the world's largest biogas upgrading project, but a testament to Greenlane's ability to provide a complete process solution and meet the challenges of the world's toughest applications.

In operation since 2017, Greenlane's scope of supply includes raw gas compression, water wash upgrading (for CO2, H2S, siloxane and VOC reduction), dehydration, oxygen polishing, off-gas treatment, and emergency flares. Site visits and/or contact information is available on request.

**Technical Data: BFI**

<table>
<thead>
<tr>
<th>Location</th>
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## Global Reference List

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</tbody>
</table>

**Additional references available upon request**
The Entsorga Group in the last 20 years has developed several proven proprietary technology platforms in the fields of waste management, recycling and the production of alternative energy/alternative fuels from unsorted, mixed and organic waste. With approximately 40 employees and collaborators, the Entsorga Group operates today over four continents through several subsidiaries, respectively focusing on: Technology licensing, design - procurement - manufacturing of key proprietary equipment, project management and CO₂ capture.

**Headquarters**

The Entsorga Group employs globally 40 people (employees and collaborators): a widespread presence allows Entsorga to ensure a strong worldwide.

**Entsorga Group Headquarters:**
S.P. per Castelnuovo Scrivia, 7
15057 Tortona (AL)
ITALY

**Phone:** +39 0131811383
Main Experiences

Entsorga Group has a 20 years long proven track record of:

- Designing, delivering and operating complete systems and commercial plants for waste processing (including aerobic and anaerobic platforms), with a total installed capacity of approximately 2 million tpa and more than 80 successful commercial references worldwide
- Designing and delivering tailor made solution for material handling, storage, transportation, dosing and feeding for a variety of materials for various industries
- Delivering proven and bankable technology solutions capable to effectively deliver sustainable solutions for the changing needs of very different markets and geographies
- Provide in partnership with selected suppliers proven and reliable equipment required for the PWD plant

Technology

More specifically Entsorga has developed a number of Proprietary Technologies to make it possible to implement composting treatment in a variety of situation: from small medium plant to large automated plants. All technologies are founded on the following principles:

- Accelerate the bio-oxidation and co digestion processes by computer controlled highly automated systems
- Carry out the treatment in enclosed spaces kept in negative pressure to avoid odor release
- Very efficient odor control on emissions by proprietary biofilters.
- Limited footprint, modularity and upgradeability
- Use of process automation in order to have a 24/7 continuous process control
- Limited labor cost provided by enhanced utilization of effective automated equipment.
- Limited exposure of operators to foul air, dust and possible pollutants. Improved working conditions and increased H&S standards when compared to more traditional platforms.
- Increased reliability of the equipment and continuous improvements provided by technical support.
11 Patents and 9 Trademarks

Technology (Continued)

With our continuous commitment in R&D, design and customer satisfaction, Entsorga can provide proprietary technology and lean and effective integrated solutions for:

- Advanced Mechanical Biological treatment
- Anaerobic Digestion and pretreatment of organic waste
- Composting
- Biomass preprocessing for Cellulosic Biofuels
- Alternative Fuels production, storage and feed lines for the Cement Industry
- Mechanical treatments (pretreatment, feeding and refining technologies)

Project Team

The Entsorga Group employs globally 40 people (employees and collaborators), with highly skilled resources supporting functions including:

- Research & Development
- Marketing and Business development
- Finance and control
- Information Technologies & Industrial Automation
- Quality assurance and Safety
- Project management
- Process control
- After sale services and customer support
- Plant management and plant operations

Others

More than 70% of the employees have a University degree and some of them have a Master’s.

- Internal operation & maintenance unit:
- Dedicated internal staff
- More than 4 contracts for the operation and maintenance for MBT and composting plants
- Process database with more than 3.000.000 data
- Dedicated processing software
# Project References

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Year</th>
<th>Status</th>
<th>Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entsorga West Virginia, LLC</td>
<td>West Virginia, USA</td>
<td>2019</td>
<td>Start-up</td>
<td>Lead Developer, technology provider, design, key proprietary equipment construction supervision, startup and commissioning support, technical services</td>
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<tr>
<td>Interserve Construction Ltd.</td>
<td>Derby, UK</td>
<td>2017</td>
<td>Operation</td>
<td>Design, supply and installation of all the Bio stabilization lines, with odour control technology</td>
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<tr>
<td>Titan Cement</td>
<td>Heliopolis, Egypt</td>
<td>2017</td>
<td>Operation</td>
<td>Upgrading of SRF line production</td>
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<tr>
<td>Tehnimarket</td>
<td>Maramures, Romania</td>
<td>2017</td>
<td>Operation</td>
<td>Design, supply and installation of the Bio stabilization and refining lines, including biofilter for odour control</td>
</tr>
<tr>
<td>Heidelberg Cement</td>
<td>Nazareth, USA</td>
<td>2016</td>
<td>Operation</td>
<td>Alternative Fuel Feeding system - SRF pneumatical feeding system to main burner</td>
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<tr>
<td>Porr Construct</td>
<td>Galda De Jos, Romania</td>
<td>2016</td>
<td>Operation</td>
<td>Design, supply and installation of the Bio stabilization and refining lines, including biofilter for odour control</td>
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<tr>
<td>La Città Verde</td>
<td>Crevalcore, Italy</td>
<td>2016</td>
<td>Operation</td>
<td>Design, supply, construction and installation of quality composting plant for kitchen waste quality composting.</td>
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<tr>
<td>Belvedere SpA</td>
<td>Peccioli, NUoro</td>
<td>2015</td>
<td>Operation</td>
<td>Design, supply, construction and installation of bio stabilization plant with odour control technology.</td>
</tr>
<tr>
<td>Hills Waste Solution Ltd.</td>
<td>Willshire, UK</td>
<td>2013</td>
<td>Operational</td>
<td>Design, supply and installation of all the Pretreatment, Bio stabilization and refining lines, including biofilter for odour control</td>
</tr>
<tr>
<td>Simbio</td>
<td>Celje, Slovenia</td>
<td>2010</td>
<td>Operational</td>
<td>Design, supply and installation of all the Pretreatment, Bio stabilization and refining lines, including biofilter for odour control for the composting and the MBT treatment plant</td>
</tr>
<tr>
<td>Territorio e Risorse Srl</td>
<td>Santhia, Italy</td>
<td>2009</td>
<td>Operational</td>
<td>Lead Developer, Owner and Operator for almost 10 years, technology provider, design, construction management, equipment procurement, construction management, start up, commissioning and training; Currently, EPC contractor for the expansion project, and O&amp;M management for the operating Composting plant</td>
</tr>
<tr>
<td>ACEA Pinerolese S.p.a</td>
<td>Pinerolo, Italy</td>
<td>2006</td>
<td>Operational</td>
<td>ACEA Pinerolese developed the technology operating in the integrated Ecopark over the years and now it is a proprietary technology covered by International patents. Entsorga is the exclusive licensee of this technology; any project based on this technology is developed by Entsorga and ACEA as partners.</td>
</tr>
</tbody>
</table>

*Additional references available upon request*
Tietjen is a specialist for grinding technology with over 60 years of experience. We are proud to produce hammermills, which are known for the extraordinary quality in different industries worldwide and to develop on the base of our enormous experience complete processes for various applications. This makes us a good partner for our customers for consultation, plant engineering, delivery, erection and commissioning all from one hand. Whether the new requirements of find grinding, crushing of bulky material, compaction, or disintegration of fibre products, whether for special machines with appropriate control and regulation or the renewal of existing equipment, we can always make a contribution and demonstrate with references.

Additionally, we take care to save energy, reduce explosion risks, promote occupational health and safety, noise or odour emission control and climate technology. We analyze local problems and provide you with our available test equipment.

The Treatment Experts for:

- Compound Feed
- Pet Food
- Fishmeal
- Wood, Cellulose, Paper
- Food

- Silage
- Biogas Substrates
- Biowaste and Food Recycling
- Minerals, Salts
- Plastic Recycling

The current managing directors Konrad Pumpe, Thomas Runde and Heiko Otte-Witte manage the company with around 60 employees. Over the last 60 years, since the supply of the first mill, over 2,100 systems have been supplied worldwide. New ideas are added daily.
Offices Location

Tietjen employs over 60 employees at our headquarter in Hemdingen near Hamburg in the north of Germany. We have branch offices in Turkey and Canada and Sales representatives in France, Belgium, and Spain as well as for South America and Asia.

Tietjen Headquarters:
Tietjen Verfahrenstechnik GmbH
Vor der Horst 6
25485 Hemdingen
Germany
Phone: +49(0) 4106 6333-0
Mail: info@tietjen-original.com

Technology

The technology used in the field of biowaste treatment is mostly the very successful DRM 800 separation system. The DRM Separation Mill has been designed for the reliable separation of the biogenic fraction of foreign substances, or contaminants from different waste streams. The goal is the optimal cleaning of the respective substrates right at the beginning of the process. The special design permits high separation performance with minimal energy. That means the DRM adds major technical as well as economic value.

The DRM-hybrid method comprises a wet product treatment. In the simplest way biomass is crushed in accordance with legal requirements for disinfection. In the same operation inorganic solids (such as packaging) are clearly separated. Our double rotor mill uses heavy hammers to open the packaging (no cutting) and to separate plastic parts (as large as possible) by its individual specific weight.

The organic fraction leaves the machine through sieves. The inorganic components pass through the vertical chute into a screw press in which the adherent organic material is removed completely and the waste dried maximally. Both material streams can then be fed without any impurities to their different processing paths. The organic fraction goes – after a potential disinfection – into biogas plant, the inorganic waste goes into thermal treatment. The necessary machinery and equipment are particularly tolerant of impurities, which are excreted in operation.

For best suitability for daily use, all components have been tested and optimized together with user operators. For example, the heavy upper housing halves can be opened by a hydraulic system for convenient maintenance. Thanks to simple technology, in the event of damage, the operators can help themselves, and not rely on specialists.
Technology and Services Portfolio
You want to process biomass. We take care of the entire process for you – from start to finish.

Experienced Consulting
Together with you, our experts develop your ideas, within the framework of local legal requirements and conditions. We want to understand your business objectives and processes from the ground up, based on a precise of your project’s definition time, financial and resource parameters.

Development & Testing
Problems cannot always be solved immediately. New ideas need testing – and we place our stationary and mobile test facilities at your disposal when required, as well as our in-house laboratory and close links with a network of leading institutes and scientists.

Project Management & Coordination
On your behalf we measure up the required plant dimensions on-site, provide you with technical and conceptual support, and ensure constant close consultation with your civil engineer and energy supplier. If required, we will also take care of statutory formalities regarding the local municipality and supervisory authorities.

Planning and Construction
Sound planning provides decision-makers and executives with vital information. The technical and schematic drawings and images we create with CAD design and 3D imaging technology will clearly illustrate all the details you need.

Production & Assembly
We manufacture high-quality machines and system components according to precise planning specifications, assemble and deliver these on time according to our contractual agreement with you. When everything comes from a single source, many questions can be answered very quickly. At Tietjen we take responsibility for meeting your requirements.

Commissioning & Training
The pre-operations inspection and acceptance of equipment confirms contractually guaranteed conditions are fulfilled. We also ensure that all aspects of operational safety have been taken into account, that the legal requirements are met, and that appropriate instruction and/or training of your operating personnel will secure professional maintenance and inspection. Frequently, instruction is repeated periodically. At Tietjen, we take the grind out of the detail to ensure you full satisfaction.

View of a Processing Plant for Commercial Biowaste
1. Waste container reception
2. Bulk loose material reception
3. Automatic bin-washing machine
4. DRM 800 hybrid
5. Empties storage area
One of the largest wastewater treatment plants in the whole of Switzerland is the ara region Bern ag. In addition to the purification of wastewater treatment plant was expanded, biowaste is also treated there. Furthermore, bio-methane for the public gas networks is produced from the organic components. The ara Bern wastewater treatment plant was expanded, to include a new receiving and processing plant for commercial biowaste. The project is one of the largest ever for Tietjen is being implemented together with a partner from the dosing and washing machine technology sector.

The first milestones had already been reached in July 2019 – by this time, most of the plant components had been delivered and the customer’s new building shell had been completed. We are proud that the partial commissioning of the processing plant took place at the end of April this year.

Hand in Hand for success
Together with our partner in the field of dosing and washing machine technology, we were able to deliver one of the best processing plants for commercial biowaste, with the Tietjen Double Rotor Separation Mill (DRM 800) in the center. In addition, our employees took over the project management, planning and organization on site. Thanks to this cooperation, all the parts for one of the most modern processing plants for food waste could be supplied from one source and individually adapted to the customer’s needs.

Functionality of the Processing Plant
The bio-waste, which comes from supermarkets, restaurants, and canteen kitchens, is delivered by lorries as well as various waste containers. The reception area, with a large bunker, provides space for unloading trucks and contains a fully automatic system for emptying, cleaning, and storing the containers. From the bunker, the homogenized bio-waste is transported to the heart of the plant: the Tietjen DRM 800.
Simple Separation and Processing of Food and Packaging

Before fermentation, it is essential to separate bio-waste from foreign matter and impurities. The more thorough and better the separation is from the beginning, the more economical is the entire process.

In contrast to conventional process technologies, the DRM 800 enables the precise separation of organic materials from all foreign matter, such as plastic packaging, right at the beginning of material processing. The shredded and mixed organic material can then be optimally recycled in terms of energy and material, while the foreign substances can be fed into thermal recycling according to type. With the lowest energy and wear and tear costs, the DRM separates foreign matter and shreds the organic material to less than 12 mm in one operation, in accordance with the legal requirements. Within the scope of this major project, Tietjen also installed two large storage tanks with a volume of 150 m³ each, to buffer the purely organic material for a constant supply for fermentation. To prevent sediments from entering the fermenter, an additional sedimentation tank was also installed by our partner. In combination with a tubular heat exchanger, the organic material thus enters the fermenter under optimal conditions. The project also included the complete pipeline construction as well as the specification of the overall process. The overall commissioning should be completed shortly.

DRM 800

- Compact, symmetrical welded/bolted stainless steel construction
- Multi-aspect process performance through impact, tearing, and shearing
- Easy adaptation of the particle size structure in organic matter through frequency-controlled drive motors and easy change sieve segments
- High tolerance to interfering and foreign substances
- Particularly easy to maintain thanks to excellent accessibility and exchangeable wearing parts
- Minimal addition of liquid—concentration of organic matter (targeted addition of process liquid, if required)
- Energy-efficient through streamlined plant design
- High operational reliability through robust design
<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Year</th>
<th>Type of Application</th>
<th>Mode of Operation</th>
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<tr>
<td>Refood</td>
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<td>ARA Bern</td>
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<td>Medoc Energies</td>
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<td>Bioenergie Meyer</td>
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<td>Heitmann</td>
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<td>Zeus</td>
<td>Reinsfeld, Germany</td>
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<td>Bimix</td>
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<td>Bimix</td>
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<td>Rotenburger Bieener-gie</td>
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<td>2005</td>
<td>NDK 9</td>
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</table>

Additional references available upon request
With more than 1,450 plants for a total of over 1,650 MW installed worldwide, AB is the global leader in cogeneration with solid experience in the design, production, installation and maintenance of industrial turnkey solutions. Since 1981 we have been working side by side with our customers to help them become more competitive through improved energy efficiency and reduced emission. Our manufacturing know-how of best-in-class power plants, combined with engineering capabilities and exceptional service support for the life of a project, is unmatched in the industry. This ensures maximum performance and reliability of the products we bring to market. Our main production and engineering activities are concentrated in the modern industrial center of Orzinuovi (located near Milan in Italy), with facilities covering over 34,000 m2 (366,000 sq. Ft). AB has local people and operations in 21 countries with local sales, service, integration, project management and staff.

We build relationships with our customers and partners based on openness and mutual trust; we manufacture and manage systems as if they were our own.

Building on our leadership position in the cogeneration sector, AB has developed gas cleaning and conditioning system for siloxane removal and landfill gas treatment. Our commitment to biofuels is furthermore substantiated through the development of modular and industrial Renewable Natural Gas (RNG) solutions. This either for injection in natural gas grids or for liquefaction. Most recently, our ongoing commitment to reducing the environmental footprint of our products has culminated in the strategic acquisition of a company specialized in the design, construction and installation of emission control technologies.

Office Locations

Today, the Group has 1,000 employees with offices in 21 countries: a widespread network which allows AB to ensure a strong presence in the specific market in terms of business activities, support and after-sales service.

AB Group Headquarter:
Via Artigianato 27
25034 Orzinuovi (BS)
ITALY

Phone: +39 0309942411

Geographical Coverage
Technology

Compactness and versatility combined with best-in-class performance make ECOMAX® the most innovative modular cogeneration solution.

An idea conceived and developed entirely by AB, ECOMAX® has become the global technological and commercial point of reference for the cogeneration sector.

Through biogas cogeneration, electrical and thermal energy is produced from a wide variety of organic substrates, such as agricultural, industrial, municipal or WWT-derived waste. Cogeneration using biogas constitutes a very interesting revenue opportunity for both agricultural/livestock businesses and public/private companies.

The ECOMAX® Biogas Line is a proved solution for all companies, thanks to a modular range starting from 300 kW plant up to those of 1,500 kW. This can be combined with the BIOCH4NGE®, the advanced biogas-to-RNG upgrading system, based on membrane technology, developed by AB.

Services

Through a global network of specialized technicians AB ensures each plant achieves maximum reliability throughout the entire life of a plant. The advantages offered by AB Service begin with the installation of the plant:

- A single partner for the entire plant, not just the engine
- A full service package that covers the whole plant and risks
- 24/7 Remote monitoring and online diagnosis
- Availability and supply of original spare parts
- Presence of qualified service technicians near installation sites
- Network of strategically placed spare parts warehouses
- Quick turnaround for repairs, updates and overhauls

Facts and Figures:

- More than 1,450 designed and installed systems
- More than 1,250 monitored installations
- More than 1,650 MW installed
- 98% average plants availability

ECOMAX® cogeneration systems effectively resolve potential requirements for on-site power and heat, providing energy to both digesters and the upgrading solution. In combination with BIOCH4NGE®, and fed by either methane or surplus biogas, we provide a flexible solution for the transition from one clean energy source to another.
Camden County Municipal Utilities Authority (CCMUA)

The CCMUA (Camden County Municipal Utilities Authority) treats approximately 60 to 90 million gallons of wastewater per day. In 2014 CCMUA decided to install a cogeneration plant to exploit biosolids generated by the wastewater treatment process. In 2019 the plant became operational and the existing infrastructure of the plant was converted into anaerobic digestors. The biogas produced is used as a primary fuel in the 2 dual fuel CHP plants of 1.9 MW each, which produce around 3.8 MW of electricity in total that is consumed locally; while the recovered thermal energy in the form of hot water is used by CCMUA to heat the anaerobic digesters. This project gives the possibility to CCMUA to decrease greenhouse emissions, create green and reliable local power and allows local job creation.

Technical Data: CCMUA

<table>
<thead>
<tr>
<th>ECOMAX®</th>
<th>2xECOMAX®20</th>
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<tbody>
<tr>
<td>Approximate Electrical Power</td>
<td>3,800 [kWe]</td>
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<tr>
<td>Application Type</td>
<td>Dual fuel: NGS + Biogas from WWT</td>
</tr>
<tr>
<td>Heat recovery</td>
<td>Hot water from the engine</td>
</tr>
</tbody>
</table>

Termoverde Caieiras:

Caieiras, in the Sao Paulo region, is the largest landfill biogas fueled power generation site in the world. The landfill receives 10-12 thousand tons of waste per day and serves 13 million people. The biogas treatment system comprises 3 lines of 7,500 m3 each, with biogas dehumidification at 5 degrees and siloxane treatment with activated carbon. This site includes 21 Ecomax® 14 Landfill Gas plants of 1,407 kWe, with a total capacity of 29,547 kWe, which work simultaneously. The electricity produced is sold to the high voltage public grid.

Technical Data: Termoverde Caieiras

<table>
<thead>
<tr>
<th>ECOMAX®</th>
<th>21xECOMAX®14</th>
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<tbody>
<tr>
<td>Approximate Electrical Power</td>
<td>29,547 [kWe]</td>
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<tr>
<td>Application Type</td>
<td>Landfill gas</td>
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<tr>
<td>Heat recovery</td>
<td>Gas to Power</td>
</tr>
</tbody>
</table>

La Castellana:

La Castellana is the farm that injected the first cubic meter of biomethane from agricultural biomasses to the grid. At La Castellana the fields are cultivated on 900 ha, about 15,000 pigs are bred, electricity is produced by two biogas plants of 999 kW and in 2018 the management decided to install an AB biogas-to-RNG upgrading plant, based on membrane technology. In 2019 the plant became operational and this installation is capable to treat 1200 normal cubic metres of biogas producing quality grade RNG to be injected in the transport grid at 25 bars.

Technical Data: La Castellana

<table>
<thead>
<tr>
<th>ECOMAX®</th>
<th>ECOMAX®3</th>
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<tbody>
<tr>
<td>Approximate Electrical Power</td>
<td>300 [kWe]</td>
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<td>BIOCH4NGE®</td>
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<td>Biogas flow</td>
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<tr>
<td>Biomethane flow</td>
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<tr>
<td>Application Type</td>
<td>Biogas &amp; RNG</td>
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<tr>
<td>Heat recovery</td>
<td>Hot water from the engine</td>
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</tbody>
</table>
## Project References

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
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</table>

Additional references available upon request
Symbiont is a nationally recognized, full-service engineering and design-build construction firm. Founded in 1981, Symbiont is a leader in municipal, energy, manufacturing, and commercial markets. From the food, beverage, brewery, and consumer packaged goods industries, to renewable energy facilities, we are knowledgeable about the unique systems and needs of each market sector.

Most organizations find the process of executing a new capital investment overwhelming. At Symbiont, we identify your needs and provide a team of experts to design and build your project. Your vision comes to life through a custom designed solution that saves you money, time, and effort. We combine our team of engineers, scientists, and constructors with the owner’s project team, synthesizing multiple perspectives to develop technological solutions that enable organizations to progress and realize their long-term business goals.

Our size is one of our greatest assets, providing a collaborative streamlined communication channel. When a new development occurs, we react quickly. Our team is headquartered in Milwaukee, Wisconsin and our fabrication shop is located in Waukesha, Wisconsin.

Across North America, we have worked in 49 states and three Canadian provinces. At project sites, our 15 permanent constructions managers provide on-site quality control and equipment testing. Seasonally, our construction crews increase to 30-50 tradesmen who combine their specialties to build structures from the ground up.

IBA Partner Company

Symbiont

80+ biogas projects | 31+ states
35,000+ scfm upgraded | 245+ MW energy produced
Design Capabilities

With a full in-house team of engineers and technicians, we provide all engineering services required to bring a project to completion. With a nimble team together under one roof, we’re able to optimize efficiency and responsiveness on every project.

Our design team features:

- 30-40 licensed Professional Engineers (P.E.) who hold licenses in states across the nation
- A licensed Professional Geologist (P.G.)
- A Geographic Information System Professional (GISP)
- A Certified Hazardous Materials Manager (CHMM)
- A Leadership in Energy and Environmental Design Accredited Professional (LEED AP)
- An Envision Sustainability Professional (ENV SP)

CADD/Modeling Services

Symbiont has utilized 3-D modeling (such as AutoCAD or MicroStation) extensively to optimize the design process. From concept, through development and final design, our 3-D models enhance client understanding and interaction throughout the project. In many cases, changes can take place in real-time so that ideas can be generated and implemented within minutes.

We utilize modeling across a breadth of projects, services, and disciplines, including:

- Wastewater treatment systems
- Pump station designs
- Wastewater diversion structures
- Municipal wastewater treatment plant studies
- pH neutralization systems
- Material handling systems
- Packaged skid designs
- Facility engineering

Fabrication Services

Symbiont understands how to reduce costs, meet schedule, and ensure equipment performance. We provide more control of these critical items through our prefabrication services. We pre-assemble skids, metal, and piping so that equipment works together like clockwork. Symbiont's prefabrication experts offer:

- Design and fabrication for smooth installation
- Advanced testing and verification programs
- Quickly paced and controlled schedules
- Skid Expertise
- Renewable natural gas (RNG) system skids
- Wastewater treatment system skids
- pH adjustment system skids
- Manufacturing system skids
- Specialty Items
- Prefabricated pipe
- Pipe support and bridge systems
- Custom metal fabrications
- Pipe threading
Automation and System Integration

We know downtime can be stressful when upgrading or modifying processes. Our automation and system integration experts design, modify, and upgrade systems that provide facilities with complete control of their operations. With your system at your fingertips, your facility operations will be crystal clear.

Whether it’s an initiative to reduce water consumption, increase production visibility, upgrade legacy controls systems, or improve flexibility, our experience places us on firm ground to help facilities realize their long-term goals.

Our Automation and System Integration Process

1. **Unified System Conceptual Plan**
   - Process/system evaluation and network architecture development
   - Production, controls, and usability requirements determination

2. **Process Control Strategy**
   - Robust and intuitive process strategy and functional description development
   - Adaptable to existing control structure

3. **Programmable Logic Controller and Human-Machine Interface Application Development**
   - Rapid development based on pre-tested software routines
   - Adaptable to existing control systems
   - Process simulation and off-site software factory acceptance testing

4. **Control Panel Design and Procurement**
   - Custom designed per required specifications
   - Compliant with evolving National Electrical Code requirements and safety standards

5. **System Commissioning and Start-up**
   - On-site commissioning and careful coordination with facility production
   - Complete start-up documentation

6. **Post Start-up Support**
   - Secure remote monitoring and on call support
   - Classroom and hands-on training
   - Controls operation and maintenance manual
Objective

This private company needed to meet east-coast compliance requirements for separating organics from landfills and needed assistance converting an abandoned biosolids processing facility to a waste-to-energy hub.

EPC Symbiont Team Approach

- Symbiont developed a guaranteed maximum price for the engineering, procurement, and construction (EPC) of the entire facility.
- After advancing the design, Symbiont utilized a fast-track construction schedule that allowed site work to start with the placement of three 59’ diameter, 1.2 million-gallon anaerobic digestion tanks, a feed buffer tank, and all associated equipment.

Process

- The recirculation pump and hot water put skids were prefabricated, tested, and verified by Symbiont’s fabrication division and shipped to the project site.
- Other equipment was procured from overseas, with Symbiont to work across time zones with anaerobic digestion equipment specialists from Germany and Denmark.
- The biogas will be treated and used in a combined heat and power system that generates electricity and thermal energy at the facility.
- Three cogenerators produce a combined 3,423 kW from 900 SCFM of biogas.
- The facility receives 200 tons per day of pre-process organics and 150 tons per day of source-separated organics.
**Project Type:** EPC  
**Market:** Energy  
**Location:** Sun Prairie, WI  
**Year:** 2020  
**Objective:**

A private energy developer wanted to create a new facility to produce RNG. They needed assistance with design, procurement, construction, installation, and commissioning of a new facility in Dane County, Wisconsin. The facility collects biogas from dairy manure, cleans and compresses the gas to pipeline-quality standards, and injects the clean gas directly into the pipeline.

**EPC Symbiont Team Approach:**

- Two challenges faced this project: designing the facility to accept and treat biogas simultaneously from two separate farms and designing the facility for a potential future expansion that would be able to accept additional biogas trucked in from other RNG facilities.
- The scope of work included the design and installation of a transfer site and upgrade facility, gas drying and transfer facility, and pipeline injection facility.
- Project features include a gas compression system and gas process skids for removal of H2O, H2S, and CO2 to reach pipeline-quality requirements for the product gas.
- Metering of incoming digester gas and outgoing renewable gas
- System designed to produce up to 600 SCFM of RNG
RNG Truck Unloading Facility Expansion

Project Type:
RNG Truck Unloading Facility Expansion

Market:
Energy

Location:
Newton, WI

Year:
2020

Objective:
A private energy developer with a high-pressure RNG truck unloading facility installed in 2018 is receiving an increased volume of RNG from farms throughout Wisconsin. They needed assistance designing and constructing an expansion to their existing unloading facility to increase trailer unload capacity by 67%.

EPC Symbiont Team Approach:
- As the Owner’s Engineer in 2018, Symbiont was familiar with the system and seamlessly transitioned to the EPC contractor for this expansion, leading the engineering, procurement, and construction of the unloading (decanting) area.
- Symbiont designed and fabricated the RNG unloading equipment, including a glycol heating skid which is used to warm the RNG and an RNG valve skid.
- The system controls RNG flow, temperature, and pressure while monitoring BTU, H2S, H2O, O2, and CO2 content to verify pipeline-quality RNG and interconnect requirements.
- Additionally, Symbiont updated the control system, tied-in new piping, erected an equipment building, and installed two truck bays for each station.
- 3,600 psi RNG trailers unload into a 975 psi utility pipeline.
## Project References

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Type</th>
<th>Source</th>
<th>State</th>
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*Additional references available upon request*
Clean Fuel Partners ("Clean Fuel" or "CFP") provides owner support in commissioning, operating, maintaining and troubleshooting anaerobic digester systems. Clean Fuel works with its clients to optimize efficiency, production and revenue for digester facilities. We do this with emphasis on the following:

- **Performance**: We focus on improving operations and maintaining peak performance levels.
- **Innovation**: We are committed to pursuing technological advances that meet waste management and environmental needs while keeping the health of the client's business in mind.
- **Advocacy**: We have a strong track record working with community, government and business leaders to support our client's needs.

Our staff of 13 has deep experience running digesters—on average 5 years. We couple this knowledge with a unique approach, bringing business solutions to digester facilities. The end result? We help our clients reach their financial and environmental goals.

**Offices Locations w/ Headquarters**

Clean Fuel Partners is headquartered in Madison, WI. We currently manage four facilities across the central part of the state. We also have staff in New England.
Services/Technology Portfolio

Operations & Maintenance ("O&M") Services

CFP offers a full spectrum of O & M services, ranging from full management of the facility to handling discrete components. We develop a customized O & M plan covering the specific needs of your business and your facility. Options available for both full-coverage (labor, parts and materials) and labor-only contracts.

- Preventive and corrective maintenance
- Data Analytics
- Biogas Management
- Parts Inventory Management
- Training & Operator development

Advisory Services

CFP’s team of industry professionals with extensive experience operating anaerobic digestion facilities along with many ancillary activities makes CFP uniquely equipped to advise facility owners and operators on the realities of anaerobic digestion, resulting in reduced downtime, optimized performance and a decrease in unexpected operational costs.

We have experience in:

- Due diligence/facility purchases
- Evaluating investments in operations
- Facility operations & turnaround execution
- Managing facilities under contract
- Facility sales

CFP starts with a thorough analysis tailored to your facility. The result a customized report and implementation plan identifying a clear path to facility performance improvement.

- Facility Evaluations & Troubleshooting
- Labor Training & Support
- System Development
- Compost Opportunities
- Site & Process Consulting
- Project Analysis
- Nutrient Concentration Systems

Project Development & Support

CFP collaborates with farm partners on projects to create sustainable solutions for system challenges. Our team pulls from years of experience and a large network of industry professionals to provide a solid business perspective that supports the farm and protects the environment.

- Construction Design Review & Bid Evaluation
- Contract Review & Negotiations
- Due Diligence
- PR & Marketing Planning
- Site Process Planning
- Financial/Budget Assessments & Analysis
- Value Engineering
- Risk Evaluations
- Employee Training & Performance Assessments
Dane County Community Digester Turn Around
December 2015 to July 2019

In December 2015, CFP purchased the Dane County Community Digester. This facility was well-known to the local press for multiple challenges. The facility supports three dairy farms representing 2500 cows. The facility itself consists of:

- Three above ground, complete mix, 1.25M gallon stainless steel digester tanks
- Piping and pumping infrastructure from three dairy farms with average intake volume of 90K gallons daily of manure slurry
- Tank storage as follows:
  - Raw manure – 50K gallons
  - Liquid substrate- 30K gallons
  - Centrate- 50K gallons
- Below ground, 50k gallon receiving pit with mixing capability to receive manure and substrates
- Originally, two 1mW Jenbacher 320 CHP units
- Centrisys horizontal decanter and fan separator
- Housing, drum dryer and conveyors for fiber drying and storage
- Related Allen-Bradley controls, piping, manifolds, pumps and material handling equipment

Because of its location in the Yahara Watershed and its proximity to a nearby creek, the facility has a requirement of 60% phosphorus removal from the watershed. This is accomplished by moving the solids outside the watershed as well as reducing the nutrient load of the centrate that is returned to the farms.

Under CFP ownership, the facility has passed through two phases: stabilization and turnaround.

**Stabilization:**

The Dane County Community digester was renowned for several gaffes prior to CFP ownership: a 400K gallon manure spill and an explosion and fire in one of the tanks. Our due diligence revealed that a lack of investment in infrastructure and parts inventory were mainly to blame. The employees had all necessary knowledge of digesters and wastewater management but didn’t have the financial support to make the investments required for sustainability and profitability.

CFP invested first in a spare parts inventory. As a result, we largely avoided the opportunity cost of downtime going forward. We also developed a routine, preventive maintenance schedule and implemented an accountability culture. Additional outcomes from these actions included increased employee morale, productivity, as well as facility uptime and gas generation.

**Turnaround:**

Focusing on processes, maintenance and analysis of substrate inputs resulted in decreased on-call shifts and overtime. The facility’s operations changed from reactive to proactive.

- Among many projects, we accomplished the following which increased production of gas at the facility at lower delivered cost:
  - Installed a new, larger centrifuge (horizontal decanter) with accompanying building, piping, pumping and surge tank,
  - Cleaned out, repaired and recommissioned Digester #3,
  - Found reliable customers for the solid fiber product, and
  - Decommissioned Digester #1 upon determining only two tanks were needed for existing feedstock volumes.

In July 2019, CFP sold the facility to Brightmark Energy. Since then, CFP has operated and maintained the facility on behalf of Brightmark. Additionally, we supported the construction, installation and now operation of a Renewable Natural Gas system.
Project References

Project 1

Client: Gundersen Health Systems

Project: Operations & Maintenance

Date: 2019 to Present

Description: Clean Fuel Partners took over O&M of two facilities for GHS in September of 2019. An immediate evaluation of the facilities was conducted resulting in the development of a prioritized project list supporting GHS' goals. CFP also provided GHS with integrated office support including automated PO system, inventory balance, facilitated billing as well as feedstock management maximizing methane production.

CFP's staff manages, operates and maintains the systems on behalf of the client. We recruit, train and employ all staffing needs to maintain efficient and effective operations.

Project 2

Client: Crave Brothers

Project: Farm Dryer

Date: 2018

Description: Crave Brothers Farm, our client and former partner, decided to install a drying system to create bedding for use in their barns. CFP worked closely with the project manager and the farm to provide the following:

- Design, construction, and commissioning assistance to the project.
- Digester cleanout and maintenance.
- Site layout for future processing buildings and equipment.
- Installation of below grade process piping.
- Foundation preparation.
- Dryer and material handling equipment install.
- Design and install of above grade process piping and separation equipment.
- Automation design assistance.
- Facility commissioning.

We continue to manage the digester, CHP unit and drying operation for the farm.

Additional references available upon request
Digester Doc is an Anaerobic Digestion consulting laboratory, specializing in biological optimization located in Boise, Idaho. We have developed long-standing customer relations with over one hundred customers across the United States. Our 20+ years of digester science experience is unmatched in the industry. Our lab focuses on serving clients in North America, but we also work with clients all over the world. We are locally operated, but internationally capable. Our laboratory is the largest anaerobic-digestion-focused facility in the world. We can help with anything from navigating the LCFS program to maximizing your gas production. We are technology and product neutral. Because we are not paid to give recommendations for specific technologies or additives, you can trust our recommendations to be the best for your system. Digester Doc is committed to helping you make your digester more stable and profitable.

Digester Doc’s core values are Innovation, Integrity, and Results.

**Digester Doc Headquarters:**

7835 W. Mossy St.
Boise, ID, USA
83709

Phone: (+1)-208-920-6000
Science and Technology

Digester Doc is actively involved with project development of anaerobic digestion systems nationwide focusing on the newest advancements in chemistry, biology, and technology.

Consulting Services
- Project feasibility analysis
- Permitting assistance
- Start up and commissioning
- Feedstock feasibility analysis
- Life-cycle analysis
- Foaming and other events
- Operating plan

Laboratory Services
- Biomethane potential
- Analytical testing
- Toxicity and Nutrient Deficiency Screening (TND)
- Fatty Acids
- Microscopy
- Feedstock performance
- Optimization studies
- Biological health determination

Monitoring
- Customized micronutrient blends
- Remote biological monitoring
- Air, soil & water monitoring
Consulting Services

Experienced Consulting

With over 20 years of experience our team of seasoned professionals has the knowledge to get the job done right the first time.

Research, Development, and Technology

We are constantly exploring and testing new technologies as they emerge. Digester Doc is committed to furthering the understanding of biology and chemistry in the industry. We are constantly researching new AD technologies and solutions.

Technology Identification

Because we have worked with so many different digesters (and digester technologies) we can provide valuable experience for developers and investors. Digester Doc can recommend technology and product solutions for each aspect of your project.

Project Feasibility Analysis

Digester Doc is experienced in project feasibility analysis having performed Phase I feasibility of 30 projects. Our analysis helps investors understand the financial and economic markers of a project’s potential.

LCFS Analysis

By reviewing information such as project plans, energy production, energy consumption, and many other factors, Digester Doc can assess many different technologies and their impact on CI scores for the LCFS program.

Permit Assistance

Whether you are dealing with EPA regulations or your local DEQ, Digester Doc can help you navigate the intricacies of the permitting process by working with many permitting professionals throughout North America.

Biological Monitoring (Valkyrie System)

Digester Doc provides a first of its kind remote AD biological health monitoring program called Valkyrie. The Valkyrie monitors parameters such as VFA, Alkalinity, FOG, BOD, COD, TOC, pH, Temperature, and more. The Valkyrie provides Digester Doc real time data that is then used to advise operators to implement corrective adjustments to AD systems. This helps the operator avoid disruptions and setbacks while increasing stability and productivity.
Laboratory and Monitoring Services

BMP Testing

This is a traditional test to quantify the biogas production of your feedstock. Samples are tested in triplicate to ensure accuracy. All BMPs are conducted in the AMPTS II unit from BioProcess Control following strict industry standards.

Toxicity and Nutrient Deficiency

Our TND reports verifies the nutrient levels in your AD’s feedstocks. If your nutrient levels are too low (or too high), you will not be getting your maximum gas yield. We test over 20 different parameters such as Potassium (affects growth rates), Arsenic (toxic to methanogens), and Chromium (aids in the metabolizing of glucose).

Customized Nutrient and Metals blending

Digester Doc takes the TND tests a step further by offering a custom blend nutrient package. This gives Digester operators the assurance of knowing that they have the correct chemistry in their system. Since feedstocks change and other variables occur, additional testing and necessary adjustments to the custom blend maintains healthy levels for the microbiology.

Optimization Study

This is a study performed with mechanical, biological, and environmental variances accounted for, to find the “sweet spot” of production for the project. This test evaluates over 2000 biological parameters in determining the optimal combination of additives to maximize biogas production. This service is backed by a 100% guarantee that we will increase your gas yields by at least 20%.

Digester Doc Tested and Verified Product/Equipment

While many products and technologies claim to increase gas yield, often they lack sufficient substantiating research. Our Five Star Verification process allows us to quantify production increases in given feedstocks. The goal of this study is to create a report that equipment providers and product suppliers can leverage to lend credibility to their product.
Ecostrat Inc. is a North American leader in assessing, developing, optimizing, and managing biomass supply chains. We are comprised of two groups:

**Biomass Advisory Group**

Ecostrat's Biomass Advisory Group is a leading North American advisory firm focused exclusively on assessing, validating and optimizing bio-based supply chains for projects across the following sectors:

- Biofuels & Biochemicals
- Biomass Heat & Power
- Pellets/ Biomaterials
- Biogas & Compost

Founded in 2008, our Biomass Advisory Group has completed over 275 feedstock consulting engagements for leading project developers, power utilities, financial institutions, investment funds, engineering companies, US Department of Energy, US National Labs, governments and First Nations across North America. Our trusted approach has been developed and refined over a decade working closely with our clients and industry experts to ensure our reports provide clear, actionable insight and the necessary data and analysis required to understand and mitigate risk.

**Methodology:**

Our trusted methodology combines industry-leading data collection methods ad analytics to deliver clear, actionable results.
Central to our methodology is sourcing and aggregating point-source data obtained directly from biomass generators and end-use markets and other industry and public-sector stakeholders. From this primary data, and with supporting data sourced from secondary sources, our analysts use industry-leading analytics to accurately model total biomass generation, material flows and market dynamics (i.e. availability of biomass as a function of price).

**Information Capital:**

Our proprietary Biomass Supply Network® is the largest and most comprehensive database of biomass availability, pricing and markets in North America. The Biomass Supply Network® is the result of over 12 years of aggregating and curating transactional market data from both suppliers and users of biomass. The Biomass Supply Network® enables best-of-kind analyses regarding biomass generation, availability and price, markets, key players, logistics, risks, and sensitivities.

**Biomass Supply Group**

Founded in 1997, our Biomass Supply Group is a North American leader in sourcing, aggregating and supplying biomass. Over 20+ years in the biomass industry, we have developed a deep understanding of the biomass supply value chain, from point of generating through to delivery of the final product and, as a result, are able to offer long-term, fixed-price supply contracts.

We currently move ~500,000 tons of biomass on an annual basis within North America, servicing a wide range of markets, including biomass heat and power, bio solidification, anaerobic digestion ("AD"), animal bedding, land application, soil amendment, compost, mulch, and wood pellet.
Offices Location w/ Headquarters

Ecostrat's head office is located at
60 St. Clair Ave. East, Suite 404,
Toronto, ON, M4T 1N5.

Services/Technology Portfolio

Real biomass supply experience, better source data, and our powerful Biomass Supply Chain Analytics® make us a recognized leader in providing actionable insight at every project stage.

Site Identification Services

An Ecostrat Site Identification Study leverages in-house, point source biomass availability and price data from our Biomass Supply Network® 3rd party datasets, and our Biomass Supply Chain Analytics (i.e. gravity modeling, GIS modeling, heat mapping, network analysis.) to deliver meaningful direction on optimal site location.

Biomass Supply Assessments

Once a site is chosen, we can help you get clear on biomass availability, competition, pricing, and risk in your project's supply basin. From high-level view, to comprehensive due diligence for project financing, we have the data and analytics to deliver the answers you need.

Project Financing Services and Due Diligence

Ecostrat is an industry leader in supply chain due diligence for project financing. Our reports are used worldwide by lenders and investors to answer critical questions pertaining to biomass availability, price and risk.

Feedstock Sourcing Services

Ecostrat is uniquely positioned to support projects in sourcing biomass. More than two decades and 5 million tons of biomass procurement experience, along with our nationwide Biomass Supply Network®, make us North America's leading biomass sourcing experts.

Supply Chain Optimizations

Supply chain optimization means decreasing feedstock costs and increasing feedstock quality and reliability. For operating plants, managing biomass feedstock costs is essential to the bottom line. Our Supply Chain Optimization program utilizes market data from our Biomass Supply Network® historical purchase data and our suite of Supply Chain Analytics to determine the optimal supplier mix.

Market Optimization and Market Studies

For over 20 years, Ecostrat's success has been built on our ability to create and access new markets for biomass. From construction and demolition wood, sawdust, wood pellets and chips to DAF, WAS and other organic food wastes, we are experts in finding the highest value markets for all types of biomass. Let us support you in accessing the very best markets for your organic or woody biomass by-products.
US National Standards for Biomass Supply Chain Risk

Client: USDA

Facility Type: All bioenergy technology platforms

Location: USA

Description: Ecostrat, working together with Idaho National Laboratory (INL) and Los Alamos National Laboratory (LANL), is developing the Biomass Supply Chain Risk Standards and Risk Rating System for the United States.

Objectives:
The primary objective of this project is to develop a framework of standards and risk quantification protocols to allow for companies in the biomass sector to clearly demonstrate their feedstock supply chain risk in a way that investors can easily understand and trust. This risk assessment architecture will provide a set of indicators, guidelines, and recommended methods and tools for quantifying supply chain risk and rating those risks on an objective and industry-approved scale.

Impacts and Outcomes:
The project outcome will be a published and validated framework of standards for US credit rating agencies, commercial lenders, and bio project investors to utilize as a common and recognized means for evaluating and quantifying the supply chain risk of biobased projects in the US. The impact of this project is accretive and immediately transferable across the full spectrum of the biobased industries: the benefits will impact bioenergy, advanced biofuels, biobased heat and power, pellet production and others. The standardized and certified risk assessment process will reduce the level of uncertainty that is a primary cause of low credit ratings and higher commercial debt costs of biobased projects across the country. The ultimate goal is to accelerate investment into the bioeconomy, unlock the significant development potential of the bio space and increase the rate of development of biobased projects in North America.

For more information visit: www.ecostrat.com/standards
Project References

Project 1: North Carolina Biomass Inventory

Facility Type: Anaerobic Digestion
Location: North Carolina
Description: RTI International, an independent, non-profit institute that provides research, development, and technical services to government and commercial clients worldwide, engaged Ecostrat as part of consortium (including Duke University, UNC, NC State) that was tasked with evaluating the opportunity for Anaerobic Digestion in North Carolina. Ecostrat was tasked with quantifying quantities of food processing waste and agricultural residues available for Anaerobic Digestion and estimated the BioMethane Potential (BMP) of those waste streams.

Specifically, this Study:

- Estimated food processing waste generation using Ecostrat’s proprietary model and compared results against a similar (Calrecycle, EPA) models;
- Conducted secondary research and outreach to food processors to estimate food waste recovery to higher value markets and estimated food waste availability for Anaerobic Digestion;
- Estimated agricultural residue generation using crop acreage, yield data, grain-to-residue conversion
- Conducted primary and secondary research to estimate quantities of residues utilized on farm or recovered for higher value markets and estimated agricultural residue availability for Anaerobic Digestion.

Project 2: Investment Due Diligence

Facility Type: Anaerobic Digester
Location: North Dakota
Description: Ecostrat conducted a comprehensive analysis of agricultural residues and organic (pre-consumer food) waste as part of an investment due diligence.

The Study utilized data sourced from literature reviews, outreach to local industry and public-sector stakeholders, research institutions, industry associations, brokers, agricultural and food processors and existing markets for targeted feedstocks.

The assessment estimated total volumes of feedstock available in the supply basin, current market pricing and included a detailed sensitivity and risk analysis, analyzing impacts of specific risk factors, and strategies to minimize impacts on the project’s supply chain.
Project References

Project 3: Lender Due Diligence

<table>
<thead>
<tr>
<th>Facility Type:</th>
<th>Anaerobic Digester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>Iowa</td>
</tr>
<tr>
<td>Description:</td>
<td>Conducted a detailed assessment of the availability and price of manure and preconsumer food waste for proposed AD project. The Study estimated total food waste generated in the supply basin, assessed existing competing markets, including intake substrate types and volumes, reviewed supply contracts, identified additional suppliers and volumes of organics available to the project, and modeled the total availability of organics as a function of price.</td>
</tr>
</tbody>
</table>

Project 4: Food Waste Procurement Support

<table>
<thead>
<tr>
<th>Facility Type:</th>
<th>Anaerobic Digester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>New England</td>
</tr>
<tr>
<td>Description:</td>
<td>Client had a need for high-strength liquid wastes, bulk solid and packaged food waste for two (2) Anaerobic Digesters under development in New England. Ecostrat identified potential suppliers, contacted each supplier to determine viability of supply to the project, and led contract development and negotiation efforts. The LOIs and executed contracts resulting from this engagement were critical to the successful financing of both projects. Now operational, feedstock is being delivered per executed contracts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Results:</th>
<th>Interested Suppliers</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tons / yr.</td>
<td>126,000</td>
</tr>
<tr>
<td></td>
<td>LOIs executed</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Tons / yr.</td>
<td>24,363</td>
</tr>
<tr>
<td></td>
<td>Contracts Executed</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Tons / yr.</td>
<td>21,683</td>
</tr>
</tbody>
</table>

Project 5: Contract Review

<table>
<thead>
<tr>
<th>Facility Type:</th>
<th>Anaerobic Digester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>California</td>
</tr>
<tr>
<td>Description:</td>
<td>Ecostrat reviewed the supply contract between the host dairy and the anaerobic digester project LLC and recommended modifying several key provisions, including:</td>
</tr>
<tr>
<td></td>
<td>▪ Force majeure;</td>
</tr>
<tr>
<td></td>
<td>▪ Term;</td>
</tr>
<tr>
<td></td>
<td>▪ Delivery of feedstock;</td>
</tr>
<tr>
<td></td>
<td>▪ Feedstock pricing;</td>
</tr>
<tr>
<td></td>
<td>▪ Return of dewatered manure for bedding;</td>
</tr>
<tr>
<td></td>
<td>▪ Termination of contract;</td>
</tr>
<tr>
<td></td>
<td>▪ Successors and assigns.</td>
</tr>
</tbody>
</table>

Additional references available upon request
Anessa is a software development firm that specializes in biogas software. Its tools are used to accurately assess the viability of potential biogas projects and to optimize the performance of existing anaerobic digestion plants through computer simulations and modelling.

Anessa’s AD•A platform answers a fundamental question with remarkable clarity and simplicity:

**Is the potential biogas project financially viable?**

Whereas AD•O (anaerobic digestion optimization) is used to fill an operational void in the industry by providing solutions to two challenges:

- What will be the future performance of the biogas plant after making changes to feedstock?
- What is the ideal recipe needed to achieve an optimization goal?

Unlike the historical practice established within the industry that has been built around proprietary spreadsheets, Anessa’s platforms provide a level of transparency that makes it possible to collaborate with stakeholders. Anessa’s AD•O software is used with both simple or complex projects including agricultural, municipal, and various food waste applications. With the ability to provide a worldwide reach, Anessa is currently serving clients in the United States, Europe, Canada, and South Africa. Confidentiality provisions in our agreements prevent us from listing our clients.

Anessa is a venture-backed startup company based in New Brunswick, Canada. The firm was founded in 2015 by passionate engineers and computer scientists who were driven to enable biogas projects by filling a void in the marketplace.
Biogas Predictive Analytics

Predictive analytics make it possible to determine the future state of a biogas operation. Instead of waiting for reports to be prepared by EPCs, consultants or other process engineers, AD•O provides a quick and accurate view.

Anessa’s simulation engine works behind the scenes to perform complex simulations and modelling. Plant operators and other stakeholders are able to have questions answered by the software which are presented in intuitive charts and graphs to quickly interpret the results, or in tables containing detailed technical data where in-depth analyses are required. When changes are being considered to any part of the feedstock cycle, for example, AD•O is able to provide accurate forecasts of many metrics including methane production, potential amounts of biogas to be flared, digestate composition, RNG or electricity to be produced.
Operational Decisions

Financial modelling is integrated into the simulations, making it possible to understand the financial implications of future changes to feedstock and other operational parameters. The benefit to plant operators is being able to implement data-driven decision rather than trial-and-error. AD•O has the ability to factor complex feed-in-tariff models and other financial schemas associated with each feedstock.

Optimization

In addition to predicting the future state of a biogas operation, AD•O can help achieve two optimization goals:

- Maximize methane production
- Maximize profit

AD•O remembers the preference during each simulation and seamlessly returns the best possible recipe needed to achieve the goal. Operation Managers can quickly plan for the appropriate feeding schedule by working from a reliable report and not gut feeling.

In one agricultural application of AD•O with approximately 100 tons of feedstock per year, the AD•O optimizer was used at a facility that was being managed by an experienced manager. Recipes produced to maximize biogas production increased performance by 16% or increasing profitability by $180,000 and when choosing profitability as the optimization goal, by 20% or $223,000 annually. Optimal recipes make a difference in biogas yield.
Feedstock Planning & Decision-Making

Whenever there are potential changes to feedstock such as availability due to seasonality or new sources from new suppliers, AD•O’s simulation engine simplifies an otherwise complex process of making feedstock planning decisions. It factors available storage, costs, methane potential, and selling price of products before generating reports in a short timeframe. Informed decisions can quickly and with confidence.

Data Log

Reporting of data at a biogas plant is often tedious, cumbersome, and inefficient especially when trying to manage the expectations of multiple stakeholders like investors or government entities. Data Log is a convenient portal to enter both input and output data, allowing biogas operators to a clean portal to store historical information. Graphs and charts are created on demand by the Anessa reporting engine.

Support Services

Each software license to use AD•O includes online training, Helpdesk support to resolve unexpected issues of a technical nature, and available support from the biogas engineering team who are frequently asked to vet numbers or entries that have been entered into the Anessa platform.
### Integrated Models
As information is added in the platform such as potential feedstock quality and quantify, reports are generated on the expected amount of biogas to be produced, profitability, the composition of the digestate as well as an extensive technical data sheet.

### Recipes
The best possible recipe for feeding the biogas plant is made available immediately following each simulation.

### Business Planning
AD•O answers the ‘what-if’ and ‘should I’ questions around feedstock with precision and clarity. This becomes especially useful when negotiating feedstock supplies or contracts, off-take agreements, or simply considering a change to feedstock, the plant configuration, or bioconversion process.

### Reports
Reports are generated on-demand and in multiple formats. Information is readily available in CSV table format when precision is required in the analyses, and in graphically rich formats when needed.

### International
AD•O can be used with biogas plants worldwide. It works seamlessly in both metric and imperial units of measure and 33 currencies.

### Secure Login
AD•O can be accessed anywhere, anytime. Multiple stakeholders can use the environment to collaborate and work cooperatively to achieve the best possible outcome for the biogas plant. One person can be adding information on possible choices of feedstock while another can access reports.

### Support
Each license includes courteous and responsive support services, all structured around

### Data Log
Housing of historical biogas input and output data that is securely stored and quickly converted into professional charts and graphs.
Hydrotech Engineering is headquartered in North Eastern Italy’s industrial corridor.

Starting in 2001 our company has experienced unparalleled growth focusing on international markets. The prerogative of the company is to design, manufacture, install and manage its installations. In less than 15 years our customer portfolio boasts numerous Fortune 500 companies.

Hydrotech Engineering realizes advanced water treatment plants for the treatment of process and waste waters utilizing the most advanced semi-permeable membrane and biological technologies for water recycling and reuse.

To guarantee optimum performance of our technology and to confidently adhere to the SLAs we control 100% of the entire project. From the project design phase to engineering, testing, manufacturing and logistics, our team owns each step of the supply chain.

The production process at HT began long ago. From the design of treatment processes, to engineering development and construction; every step is directly executed in our workshop. Continuous testing through onsite pilots and our advanced laboratories have allowed for perpetual fine-tuning. Our highly experienced technicians continue to improve the production processes and the quality of our machines. This is achieved by acknowledging the needs and the feedback from our clients. Another core differentiator is our focus on the automation, the control plants and their consequent energy efficiency. For this reason, the design, construction and development of all automation components including control software of the installations are developed exclusively in-house.
Office Locations

Today, our global team coordinates its efforts between the headquarter office in Italy and the sister companies in Asia and North America.

Headquarter Italy
Headquarter: Bastia di Rovolon
Padua, Italy
e-mail: info@hydrotechengineering.com
Tel. +39 049 9913630

North America
North American Office
e-mail: americas@hydrotechengineering.com
Tel. +1 925 8785830

Asia
Indian Office
e-mail: asia@hydrotechengineering.com
Tel. +91 11 28525801
**Digestate Technology**

Anaerobic Digestion is a biological process by which the organic matter from various origin is turned into biogas for energy production. This energy production process generates a residual product called anaerobic digestate. The characteristics of this residual product are: organic matter difficult to biodegrade, high presence of suspended solids and an elevated nitrogen concentration. Hydrotech Engineering uses the most modern technologies in the field of semipermeable membranes which allow the removal and recovery of nitrogen present in digestate. In addition, high quality water is obtained which can be reutilized in the industrial process or discharged in accordance to the most stringent environmental regulations.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD reduction</td>
<td>99.8 %</td>
</tr>
<tr>
<td>TS reduction</td>
<td>99.5 %</td>
</tr>
<tr>
<td>TKN reduction</td>
<td>99.4 %</td>
</tr>
<tr>
<td>Recovery up to RO only</td>
<td>75.0-80.0 %</td>
</tr>
</tbody>
</table>

(purified water/inlet digestate)
The Process

Hydrotech Engineering has developed a multi-step process to treat digestate in the most efficient method. Our process encompasses the following steps: MBR, side stream Ultra Filtration and double stage/double pass Reverse Osmosis.

80% pure water which meets all discharge limits. Example: COD levels up to 10ppm. Clients reutilize this rich source of pure water for their industrial needs on site.

20% Reverse Osmosis concentrate that can be either evaporated into an organic fertilizer or utilized in the humidification process for compost production.

Services Portfolio

HT offers a broad portfolio of services that are tailored to customers specific requirements.

Just a few of the service that HT can provide are:

- Engineering & Design
- Skilled Manufacturing
- Installation/Commissioning
- Maintenance Service
- Remote Supervision And Control
- Training
- After-sales Service
S.E.S.A. S.p.A., predominantly a public capital society, serves Municipalities mainly by providing services of waste recovery and recycling activities, disposal, transport and waste management.

In 1997 the Company built the first composting plant and after few years the plant was completed with the anaerobic digestion and the production of biogas.

Over the years investments have always been made by adopting the best technologies for each single sector involved. Hydrotech Engineering is proud to have supplied the plant for the treatment of the digestate liquid fraction.

### Technical Data: S.E.S.A. S.p.A.

<table>
<thead>
<tr>
<th>Feedstocks</th>
<th>Municipal Organic Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>730,000 tons/year</td>
</tr>
</tbody>
</table>
## Project References

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Year</th>
<th>Status</th>
<th>Substrates</th>
<th>Technical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrilux Srl</td>
<td>Italy</td>
<td>2020</td>
<td>Under Construction</td>
<td>Organic Waste</td>
<td>Capacity: 300 m³/d</td>
</tr>
<tr>
<td>S.E.S.A. Spa</td>
<td>Italy</td>
<td>2020</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 500 m³/d</td>
</tr>
<tr>
<td>Bioman Spa</td>
<td>Italy</td>
<td>2020</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 1500 m³/d</td>
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<tr>
<td>Arsec</td>
<td>Japan</td>
<td>2020</td>
<td>Pilot Plant</td>
<td>Organic Waste</td>
<td>Capacity: 1,5 m³/d</td>
</tr>
<tr>
<td>Alman Srl</td>
<td>Italy</td>
<td>2019</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 40 m³/d</td>
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<tr>
<td>S.E.S.A. Spa</td>
<td>Italy</td>
<td>2019</td>
<td>Under Construction</td>
<td>Organic Waste</td>
<td>Capacity: 600 m³/d</td>
</tr>
<tr>
<td>Bioman Spa</td>
<td>Italy</td>
<td>2018</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 600 m³/d</td>
</tr>
<tr>
<td>Sebigas Spa</td>
<td>Italy</td>
<td>2018</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 150 m³/d</td>
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<td>S.E.S.A. Spa</td>
<td>Italy</td>
<td>2017</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 1400 m³/d</td>
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<tr>
<td>S.E.S.A. Spa</td>
<td>Italy</td>
<td>2017</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 600 m³/d</td>
</tr>
<tr>
<td>S.E.S.A. Spa</td>
<td>Italy</td>
<td>2016</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 800 m³/d</td>
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<tr>
<td>N.D.</td>
<td>France</td>
<td>2014</td>
<td>In Service</td>
<td>Manure</td>
<td>Capacity: 380 m³/d</td>
</tr>
<tr>
<td>S.E.S.A. Spa</td>
<td>Italy</td>
<td>2014</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 300 m³/d</td>
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<tr>
<td>Fertitalia Srl</td>
<td>Italy</td>
<td>2012</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 300 m³/d</td>
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<tr>
<td>Berica Impianti Energia Srl</td>
<td>Italy</td>
<td>2012</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 120 m³/d</td>
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<tr>
<td>Bioman Spa</td>
<td>Italy</td>
<td>2012</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 300 m³/d</td>
</tr>
<tr>
<td>Fertitalia Spa</td>
<td>Italy</td>
<td>2010</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 100 m³/d</td>
</tr>
<tr>
<td>Consorzio Agrilux</td>
<td>Italy</td>
<td>2010</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 250 m³/d</td>
</tr>
<tr>
<td>S.E.S.A. Spa</td>
<td>Italy</td>
<td>2009</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 300 m³/d</td>
</tr>
<tr>
<td>S.E.S.A. Spa</td>
<td>Italy</td>
<td>2008</td>
<td>In Service</td>
<td>Organic Waste</td>
<td>Capacity: 300 m³/d</td>
</tr>
</tbody>
</table>

*Additional references available upon request*
Schumann Tanks is a global tank construction company specialized in the design, manufacture, supply, and installation of bolted steel tanks. For over 20 years, Schumann Tanks employs experienced engineers and technicians which are constantly working on innovations to meet the ever-increasing demands of the tank industry.

Different material choices and a modular bolted tank design allow the configuration for different applications. Today, as part of the global energy transition, Schumann Tanks focuses mainly on producing and installing biogas digester and wastewater tanks.

For each individual tank, customers can choose not only from various materials such as stainless steel, glass-coated carbon steel or steel with the special KTL coating, a unique coating for anaerobic digesters, but also from different additional equipment and accessories, ranging from tank insulation over walkways to pressure relief valves.

The main goal of Schumann Tanks is customer satisfaction by ensuring quality, service and reliability for your product.

Office Locations

Schumann Tanks employees more than 70 professionals at different locations in Europe, Asia, and North America.

**Headquarters, Germany**
Schumann Tanks GmbH
Steinfeldstr. 3, 39179 Barleben, Germany

**USA**
Schumann Tanks USA Corp.
777 Brickell Ave, Suite 500
Miami, FL 33131

**Asia**
Schumann Tanks Asia
58 Gongnong Road, Jishui Town
Weihi City, Henan Province
China
Services

Schumann's tanks are suitable for the storage of various liquids and bulk materials. The wide range of tank diameters and heights allows the use of the most suitable tank for every plant. The tanks are provided with different covers and roof constructions or with open top. Upon request, the tanks can also be manufactured as gas-tight versions. The equipment is assembled and erected on site from prefabricated steel plates with an assembly lifting system which allows work at ground level and short installation times. The tanks can thus be completed within a short time. At any time, the tanks can be dismantled and reassembled at other locations.

Applications and Portfolio

Schumann Tanks offers various tanks such as Sprinkler, Drinking Water, Wastewater Tanks or Biogas Digesters for almost every application. The selection of different materials such as black steel, galvanized steel, enameled steel, and different types of stainless steel ensures that there is always a tank from Schumann Tanks that best suits the respective medium. The wide range of sealing materials offers a solution for every liquid and every process.

Stainless Steel Tanks

The advantages of stainless steel are widely known. Stainless steel is a suitable product not only for the Food sector (drinking water processors, breweries, beverage industry, dairies, fish processing industry, etc.) but also for other industrial sectors such as petrochemical, biogas and bioethanol industry. Stainless steel tanks are manufactured for the customers’ desired quality and size in Schumann Tanks own production.

Glass-enameled Steel Tanks

A glass-enameled tank offers a qualitatively equivalent and inexpensive alternative to a stainless steel tank. The fusion of glass and steel at a high temperature produces a durable, resistant coating that combines the strength and flexibility of steel with the protection of glass against corrosion. Schumann offers glass-enameled tanks from world leading brand manufacturers.
Epoxy Coated Steel Tanks

Compared to glass coated containers, epoxy coatings have been introduced to the market as an alternative for certain storage applications. Epoxy powder coating is a newer application method with lower costs compared to other materials. The protection against liquids (inside the container) is provided by a 250 µm thick epoxy layer, while the coating is finished on the outside with a UV-resistant polyester layer.

KTL Steel Tanks

Unique System for Anaerobic Digesters

Black steel combined with the special KTL corrosion coating has found a wide range of applications in biogas technology. A tank made of black steel, with the special temporary corrosion protection and a professional assembly by our technicians, offers an inexpensive alternative to stainless steel or glass-enameled tanks in terms of quality and durability. The upper ring element and the roof panels are made of stainless steel due to the gas contact.

Roof Constructions

Schumann Tanks portfolio offers different roof constructions depending on the application. The roof types include:

- Heavy Duty Roof (external hdg supported)
- Light Duty Roof (self-supported or external hdg supported)
- Aluminum Dome
- Membrane Cover

Additional Features and Accessories

Not only the manufacture and installation of the tank structure itself are part of Schumann Tanks services. Their portfolio also includes roof and wall insulation, customized walkways, access stairs or ladders, service balconies, tank protection equipment like pressure relief valves or internal heating systems. For their full range of services, please visit Schumann Tanks website at www.schumann-tanks.com.
As in many other industries, there is a trend to get bigger and bigger every time. The same happens in the world of anaerobic digestion, where it is necessary to have more digester volume in a single tank, while maintaining the same mixing conditions inside the digester.

This development led to Schumann being asked several years ago to develop a so-called 9.6K (9,600 m³ / 2.54M US gallon gross volume) Danish style digester. The bolted tank is designed to maintain a 1:1 ratio between diameter and height.

The unique Danish style digester is a hybrid construction with the gas zone being made of 316 stainless steel (L/Ti). The liquid level consists mainly of carbon steel with a temporary KTL corrosion protection coating. The digesters are equipped with a vertical mixing system that is fixed to the roof construction which is external supported by hot-dip galvanized beams. All other external reinforcements are also made of hot-dip galvanized steel.
**Technical Data: Nature Energy Korskro**

<table>
<thead>
<tr>
<th>Location</th>
<th>Korskro, Denmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of Operation</td>
<td>August 2019</td>
</tr>
<tr>
<td>Customer</td>
<td>Nature Energy Korskro A/S</td>
</tr>
<tr>
<td><strong>Tank Data</strong></td>
<td></td>
</tr>
<tr>
<td>7x 2.54 M gallon anaerobic digester tanks with a diameter of 78.44 ft and a height of 69.12 ft</td>
<td></td>
</tr>
<tr>
<td>Each tank equipped with 1 vertical mixer</td>
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</tr>
<tr>
<td>Completely insulated and cladded tanks</td>
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<tr>
<td>All tank connected with bridges, access by 2x spiral staircases</td>
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<tr>
<td>RNG production: ~22 Million Nm³/year</td>
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</tbody>
</table>
## Project References

<table>
<thead>
<tr>
<th>Customer</th>
<th>Location</th>
<th>Construction Year</th>
<th>Technical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bigadan A/S</td>
<td>Horsens, Denmark</td>
<td>2021 / Design Phase</td>
<td>3x 9,600 m³ / 2.54M gal Anaerobic Digester</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(w/ Heavy Duty Roof + Top Ring in AISI316, Tank Shell in CS KTL coated, incl. insulation and cladding)</td>
</tr>
<tr>
<td>Bigadan A/S</td>
<td>Aabenraa, Denmark</td>
<td>2020 / Under Construction</td>
<td>12x 9,600 m³ / 2.54M gal Anaerobic Digester</td>
</tr>
<tr>
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<td>(w/ Heavy Duty Roof + Top Ring in AISI316, Tank Shell in CS KTL coated, incl. insulation and cladding)</td>
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<tr>
<td>Blaaberg Biogas AMBA</td>
<td>Herning, Denmark</td>
<td>2020 / Under Construction</td>
<td>1x 9,600 m³ / 2.54M gal Anaerobic Digester</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>(w/ Heavy Duty Roof + Top Ring in AISI316, Tank Shell in CS KTL coated, incl. insulation and cladding)</td>
</tr>
<tr>
<td>Atlantic Packaging</td>
<td>Whitby, Canada</td>
<td>2020 / Under Construction</td>
<td>1x 3,400 m³ / 900k gal Reactor Tank AISI304/316 (w/ heavy duty roof and cone bottom)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1x 1,800 m³ / 475k gal Wastewater Tank AISI304 (w/ steel floor and heavy duty roof)</td>
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<tr>
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<td></td>
<td></td>
<td>8x 310m³ / 80k gal Wastewater Tanks AISI304 (w/ steel floor and light duty roof)</td>
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<tr>
<td>FonnRoche</td>
<td>La Pommeraie-sur-Sevre, France</td>
<td>2020 / Project completed</td>
<td>1x 9,600 m³ / 2.54M gal Anaerobic Digester</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>(w/ Heavy Duty Roof + Top Ring in AISI316, Tank Shell in CS KTL coated, incl. insulation and cladding)</td>
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<tr>
<td>ESA Group</td>
<td>Eskehir, Turkey Konya, Turkey</td>
<td>2020 / Project completed</td>
<td>5x 7,600 m³ / 2.00M gal Anaerobic Digester</td>
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<td>(w/ Heavy Duty Roof + Top Ring in AISI316, Tank Shell in CS KTL coated)</td>
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<tr>
<td>Symbiont Constructions</td>
<td>St. Johns, MI, USA</td>
<td>2019 / Project completed</td>
<td>3x 2,100m³ / 550k gal AC&amp;EQ Tanks AISI304 (w/ heavy duty roof, incl. insulation and cladding)</td>
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<td>1x 6,400m³ / 1.7M gal Aeration Basin CS Epoxy</td>
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<tr>
<td>Revis Bioenergy</td>
<td>Duelmen, Germany</td>
<td>2019 / Project completed</td>
<td>3x 9,600 m³ / 2.54M gal Anaerobic Digester</td>
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<td>(w/ Heavy Duty Roof + Top Ring in AISI316, Tank Shell in CS KTL coated, incl. insulation and cladding)</td>
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<tr>
<td>TICSA</td>
<td>Obregon, Mexico</td>
<td>2019 / Project completed</td>
<td>1x 1,600 m³ / 420k gal ECSB Biobed Digester AISI304</td>
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<td>(w/ Heavy Duty Roof)</td>
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<tr>
<td>Anaergia</td>
<td>Camden, NJ, USA</td>
<td>2019 / Project completed</td>
<td>4x D=21.5m / 70.5 ft Heavy Duty Roof Covers AISI316 put on concrete tanks</td>
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<tr>
<td>Portland</td>
<td>Portland, OR, USA</td>
<td>2019 / Project completed</td>
<td>4x 6,700 m³ / 1.75m gal Anaerobic Digester CS KTL</td>
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<td></td>
<td>2x 5,500 m³ / 1.45M gal Anaerobic Digester CS glass (all w/ Heavy Duty Roof + Top Ring in AISI316, incl. insulation and cladding)</td>
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<tr>
<td>Botres Global</td>
<td>Gello Pontedera, Italy</td>
<td>2018 / Project completed</td>
<td>2x 9,500 m³ / 2.50M gal Anaerobic Digester CS KTL</td>
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<td></td>
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<td>1x 4,900 m³ / 1.30 M gal Anaerobic Digester CS glass/KTL coated (all w/ Heavy Duty Roof + Top Ring in AISI316, incl. insulation and cladding)</td>
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<tr>
<td>Mc Connell Dowell</td>
<td>Rarotonga, Cook Islands</td>
<td>2018 / Project completed</td>
<td>4x 2,600m³ / 685k gal, 3x 1,600m³ / 420k gal and 2x 700m³ / 185k gal Potable Water Storage tanks AISI 304 with Geodesic Aluminum Dome roofs</td>
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<tr>
<td>Anaergia</td>
<td>Toyko, Japan</td>
<td>2018 / Project completed</td>
<td>1x 3,000m³ / 800k gal Anaerobic Digester outer tank 316/CS glass</td>
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<td>1x 2,400m³ / 635k gal Digester inner tank AISI316/304 (w/ Heavy Duty Roof)</td>
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<tr>
<td>Trenton Biogas</td>
<td>Trenton, NJ, USA</td>
<td>2018 / Project completed</td>
<td>3x 4,800m³ / 1.25M gal Anaerobic Digesters CS KTL</td>
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<tr>
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<td>1x 1,800m³ / 475k gal Receiving Tank CS glass (w/ Heavy Duty Roof + Top Ring AISI316, incl. Insulation and Cladding)</td>
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<tr>
<td>Nature Energy Korskro A/S</td>
<td>Korskro, Denmark</td>
<td>2017 / Project completed</td>
<td>7x 9,600 m³ / 2.54M gal Anaerobic Digester</td>
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<tr>
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<td></td>
<td></td>
<td>(w/ Heavy Duty Roof + Top Ring in AISI316, Tank Shell in CS KTL coated, incl. insulation and cladding)</td>
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Additional references available upon request