P.M.C

Feasibility Study for Biogas Generation in Waste Water Treatment

Pars Marine Industry Co. (PMC)

#8, Ararat St., Vanak, Tehran, IRAN

TEL/FAX: +98-21-8805 8851 & 2
+98-21-88042014

www.ParsMarineCo.com

5. Biogas plants

5.1. Company Profile

- **30 years** of experience in environmental technology (Management-Buy-Out in 2007)
- **Business segments**: Engineering, Own Plant Operations and Agriculture
- **Scope of services**: project development, planning, submission, funding, turnkey systems, start up, plant management and maintenance/after sales service, operation
- **Offices** in Austria (Vienna, Linz), the Czech Republic (Breclav), Italy (Milano), Romania (Timisoara), Serbia (NoviSad), United Kingdom (Dumfries) and United States of America (Denver, CO)
- **Markets**: Central-, Eastern- and South-Eastern Europe, Italy, France, GIS, Republic of Ireland and United Kingdom, USA and South-East Asia

5.2 References (planning and construction)

Year	Project	Size
2021	DOBANGYUKJONG FARM (KOR)	190 KW
2021	OAK VALLEY I EXTENSION (US)	140 Nm3/h
2021	OAK VALLEY V (US)	108 Nm3/h
2021	METHABOUE (FR)	- Nm3/h
2021	CONGRIER (FR)	140 Nm3/h
2021	MEGARCHI TRIKALA (GR)	1000 KW
2021	RHODES (GR)	500 kW
2021	MILL VALLEY (US)	138 Nm3/h
2021	FULL CIRCLE (US)	323 Nm3/h
2021	FONTAINE AGRIGAZ (FR)	250 Nm3/h
2020	GLENMORE (IE)	3 900 kW
2020	METHA DES BOSQUETS ENERFA (FR)	140 Nm^3/h
2020	CORUM (TR)	950 kW
2020	ANKA (TR)	1 500 kW
2020	OAK VALLEY 1 (US)	420 Nm3/h
2020	ENFIELD (UK)	extension
2020	FROGMARY 3 (UK)	extension
2019	AKYURT I (TR)	3 000 kW
2019	HC KOREA (AS)	100 kW
2019	CONFOLENS (FR)	235 Nm3/h
2019	ZELARINO (IT)	300 kW
2018	UNIVERSITY (IN)	100 kW
2018	AKYURT II (TR)	3 000 kW
2018	WORTHY FARM	124 kW
2018	FROGMARY ERW (UK)	Extension
2018	METHA CONFOLENTAIS (FR)	235 Nm^3/h
2017	WITTERSHEIM (FR)	700 Nm^3/h
2017	WILLAND (UK)	500 kW + 1000 nm^3/h
2017	AGROPLUS (RS)	1000 kW
2017	CESTEREG (RS)	600 kW
2017	CHARCHIGNE (FR)	3 600 kW
2017	AHI ENERGI (TK)	6 500 kW
2017	SLADOJEVCI (HR)	1 000 kW
2016	STARA PAZOVA 2 (RS)	637 kW
2016	PENGELLY (UK)	1 000 kW
2016	ARKLEBY HALL (UK)	499 KW
2015	BURTON AGNES (UK)	500 kW + 1000 nm^3/h
2015	FROGMARY (UK)	500 kW + 1000 nm^3/h
2015	RUSHYWOOD (UK)	500 kW
2015	GREAT HELE (UK)	500 kW
2015	POLLYBELL (UK)	500 kW + 1000 nm^3/h

BIOGEST®
BIOGAS

2015	PULLACH (DE)	500 kW
2015	HONEYBOURNE (UK)	500 kW
2015	KINGSWEEK (UK)	250 kW
2015	MILL-NURSERIES (UK)	2 000 kW
2015	HILLFIELDS (UK)	124 kW
2015	MANN (UK)	124 kW
2015	JOHNSTON (UK)	124 kW
2014	ARDUD (RO)	1500 KW
2014	BILSTROPHE (UK)	500 kW + 1000 nm^3/h
2014	ENFIELD (UK)	500 kW + 1000 nm^3/h
2014	MONIKI (UK)	500 KW
2014	COSTON (UK)	500kW
2014	SOLAR (BG)	637 kW
2014	DODDS (UK)	124 kW
2014	LITTLETON (UK)	124 kW
2014	CALLENDER (UK)	124 kW
2014	GLEBE (UK)	124 kW
2014	Y-FARMS (UK)	124 kW
2014	BROADMEADOWS (UK)	124 kW
2014	BJALO POLE (BG)	600 kW
2014	STAMBOLIJSKI (BG)	1 000 kW
2014	AKSAKOVO (BG)	1 000 kW
2014	SLAVYANOVO (BG)	800 kW
2014	ABERDEEN (UK)	526 kW
2014	HOGSBROOK (UK)	1 300 kW
2014	BRAMHAM (UK)	1 200 kW
2014	DJULOVAC (HR)	1 000 kW
2014	TINWALD (UK)	1 200 KW
2013	JUSTICETOWN (UK)	100 kW
2013	KIRKBRIDE HOUSE / Little (UK)	500 kW
2013	VRBAS II (RS)	500 kW
2013	ZALUZI-MORINA II (CZ)	549 kW
2013	BELCICE (CZ)	526 kW
2013	TAKO (CZ)	549 kW
2013	GELTBRIDGE (UK)	250 kW
2013	PECKMOOR (UK)	500 kW
2013	BEARLEY (UK)	2 000 kW
2013	CHAVANAGE (UK)	2 000 kW
2013	CHOTYCANY II (CZ)	99 kW
2013	GARBOVA (RO)	1 000 kW
2013	CEFA BIHOR (RO)	2 900 kW
2013	VETRKOVICE (CZ)	526 kW
2013	TOPOLJE 1 (HR)	330 kW
2013	KLOUZOVICE II (CZ)	526 kW
2013	STARA PAZOVA II (RS)	300 kW

2012	LYSICE-BYCKOVICE (CZ)	548 kW
2012	BALS (CZ)	1000 kW
2012	TOFALU (HU)	1000 kW
2012	AVICOLA (RO)	600 kW
2012	DOBRICH (BG)	800 kW
2012	SATU MARE (RO)	1500 kW
2012	MECIN (CZ)	600 kW
2012	STRIZOVICE II (CZ)	600 kW
2012	SKALSKO (CZ)	600 kW
2012	STRIZOVICE (CZ)	600 kW
2012	HORINEVES (CZ)	1 000 kW
2012	ZAKAVA (CZ)	998 kW
2012	LUKOVA (CZ)	600 kW
2012	LHOTA POD LIBCANY (CZ)	600 kW
2012	TISOVA (CZ)	999 KW

5.3. Photos

Bramham (UK) 1200 kW, 2014

Coston (UK) 500 kW, 2014

Krizanov (CZ) 526kW, 2008

Aberdeen (UK) 526 kW, 2014

Djulovac (HR) 1000 kW, 2014

Enfield (UK) 520Nm^3/h CH_4, 2016

Frogmary (UK) 520Nm^3/h CH_4, 2016

Great Hele (UK) 520 Nm^3/h CH_4, 2017

Crofthead (UK) 124 kW, 2014

Pars Marine Industry Co. (PMC) Official Representative of Biogest in IRAN

www.ParsMarineCo.com

PowerCompact

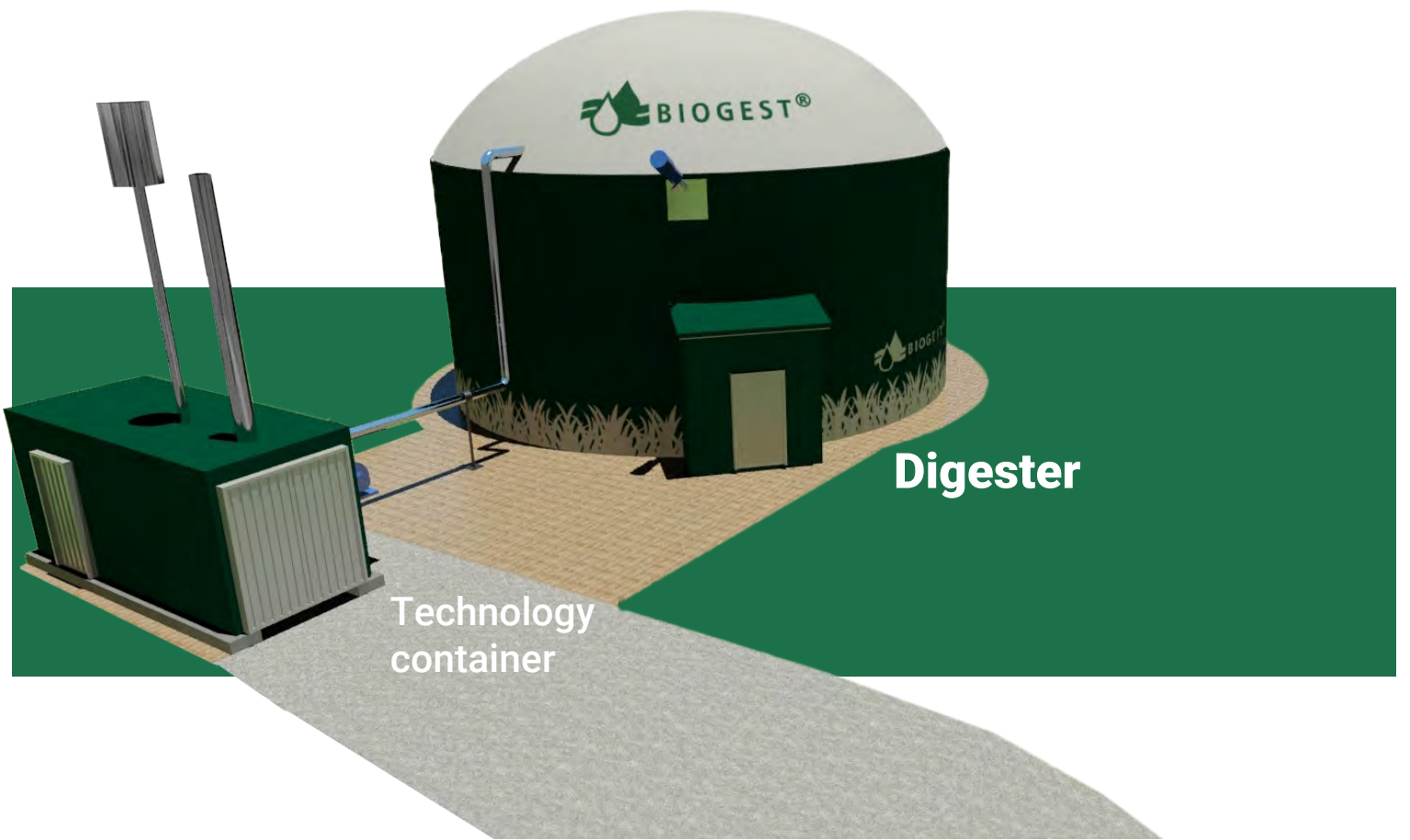
Technical Data Sheet

Plug and Play

Advantages

- Easy operation and maintenance
- Compact, modular design
- Plug and play
- Operates at full capacity
- Short construction time

The biogas PowerCompact micro plant is an anaerobic digester unit designed especially to fit the needs of small-scale dairy farmers.



Improve your dairy farm

The PowerCompact micro plant concept allows small and medium-sized farms to keep their focus on livestock, while improving profitability, by producing up to 250 kW_{el} for input into the electricity network or for on-farm consumption.

Flexible feedstock

The PowerCompact plant can run either on slurry only or in combination with small amounts of silage or feed leftovers in order to boost gas production, depending on the on-farm availability. The matrix below shows the ratio of electrical output (in kW) to feedstock levels for a 100 kW plant.

Top components, best-of-class technology

During the selection process of high-quality plant components, special attention is paid to technology with a good price-performance ratio that was made from well-known, experienced European manufacturers.

Easy operation and maintenance

The system is designed to be operated in an agricultural environment with no prior knowledge of the topic or additional employees required. Remote control via PC or smartphone is part of the package. Most of the maintenance can be performed on a do-it-yourself basis or by our local service team, which is also ready to deliver and install spare parts if required.

Plug and Play

Due to its compact, modular design, the plant needs a minimum footprint of 1,000m². The system is tailor-made to the particular operating conditions in terms of size and power capacity. Since installation of this standardized system is simple and the start-up time is short the system can be put in operation quickly.

Compact, modular design

The plant consists of the digester and the technology container. While the digester is a tank with a gas dome on top, the remainder of the technology fits into a single prefabricated container.
To save space and construction time, the technology container includes a combined heat and power (CHP) unit, a heating system and an integrated control room. In addition, the system is expandable with numerous options. This flexible approach enables the plant to be readily integrated into an existing infrastructure and can be expanded at any time.
With the PowerCompact concept and technology, you produce your own energy! Farms in remote areas have the option to run in island mode.

Operates at full capacity

The PowerCompact micro plant is designed to run at full capacity throughout the whole year, when using the recommended feedstock.

Covering the entire value chain

Our cost-effective and resource-saving solutions, based on technically advanced designs, contribute to an environmentally friendly future by providing green and sustainable energy. The scope of Biogest services range from project feasibility studies, design development and business planning to turnkey construction and commissioning of plants.

Service and maintenance

Our clients also trust our expertise when it comes to operation and maintenance, for which we offer tailor-made service agreements. Furthermore, we offer an eShop for our clients, where our customers can order spare and wear parts on a one-click basis via an app on your smartphone or desktop computer.

BIOGEST® Biogas Plant 100 kW: substrate matrix

Range of electrical output [kW] in relation to substrate mix

	Maize silage (32% dm)	0,0 t/d	0,2 t/d	0,6 t/d	1,1 t/d	1,5 t/d	2,0 t/d	2,4 t/d	2,9 t/d	3,3 t/d	3,8 t/d	4,2 t/d	4,7 t/d	5,1 t/d	5,6 t/d
	Grass silage (30% dm)	0,0 t/d	0,2 t/d	0,7 t/d	1,2 t/d	1,7 t/d	2,3 t/d	2,8 t/d	3,3 t/d	3,8 t/d	4,3 t/d	4,8 t/d	5,3 t/d	5,9 t/d	6,4 t/d
Cattle slurry (10% dm)	60 heads	3 t/d								64 kW	71 kW	78 kW	85 kW	93 kW	100 kW
	105 heads	6 t/d							64 kW	71 kW	78 kW	85 kW	93 kW	100 kW	
	150 heads	8 t/d						64 kW	71 kW	78 kW	85 kW	93 kW	100 kW		
	195 heads	11 t/d					64 kW	71 kW	78 kW	85 kW	93 kW	100 kW			
	240 heads	13 t/d				63 kW	71 kW	78 kW	85 kW	93 kW	100 kW				
	285 heads	15 t/d			64 kW	71 kW	78 kW	85 kW	93 kW	100 kW					
	330 heads	18 t/d		64 kW	71 kW	78 kW	85 kW	93 kW	100 kW						
	375 heads	20 t/d	68 kW	71 kW	78 kW	85 kW	93 kW	100 kW							
	420 heads	23 t/d	68 kW	71 kW	78 kW	85 kW	93 kW	100 kW							

Feeding system required
No feeding system

Headquarters

BIOQUADRAT Energie- und Wassertechnik Holding GmbH

THE ICON VIENNA Central Station
Gertrude-Froehlich-Sandner Straße 2-4
Tower 9, Floor 9
A-1100 Vienna, Austria

Contact

T +43 1 2260700
office@biogest.at
www.biogest.at

Worldwide Offices

BIOGEST®

Pars Marine Industry Co. (PMC) Official Representative of Biogest in IRAN

www.ParsMarineCo.com

PowerDigest

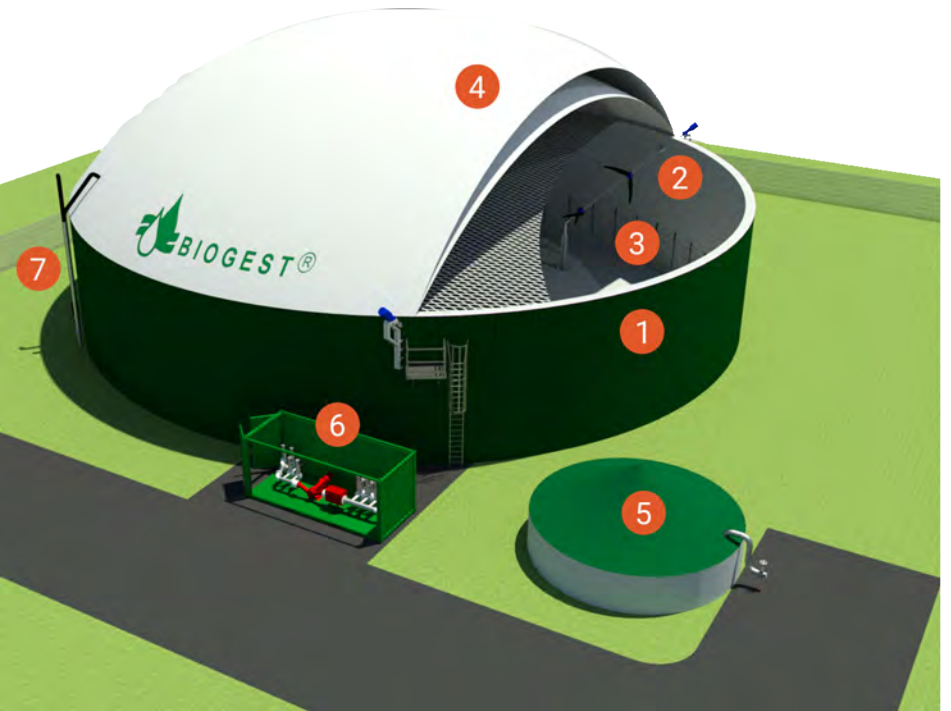
Technical Data Sheet

The straightforward & classical solution

Advantages

- Space saving design
- Ideally suited for liquid byproducts
- Outstanding biological desulphurization
- High full-load hours
- Easy to extent with more feedstock
- Time saving option

The PowerDigest has been developed for feedstock with low dry matter. It is ideally suited for large cattle farms, as well as for the agro-industrial sector.



1. Primary digester
2. Agitation system
3. Heating system
4. Gasholder inner and outer membrane
5. Reception pit
6. Central pumping station
7. Pressure relief valve

Technology highlights

The PowerDigest consists of a concrete or steel tank with a gasholder on top to guarantee space saving and a compact design. Due to our long-shaft mixers, a good homogenization of the feedstock can be achieved, fostering the degradation of the biomass. Moreover, the PowerDigest includes an improved biological desulphurization solution which decreases significantly the H_2S content, minimizing the amount of active carbon needed for downstream gas cleaning. Furthermore, its gravitational overflow helps to reduce electrical consumption.

Modular design

Due to its high flexibility, it is possible to combine as many PowerDigest as needed to treat all the available feedstock. In addition, this plant can work with a CHP, a gas upgrading unit, or a boiler as downstream processing equipment without any complicated interfaces or gas losses. In our plants we reach average full-load hours of more than 94%. The equipment of the plant can be either placed in an operational building or be delivered in practical 20-foot containers to be just placed on site – a time saving option!

High reliability and easy maintenance

Only reliable plant components from reputable suppliers have been chosen for this plant. Special focus lies on the agitation technology, which is very efficient due to the use of strategically placed long-shaft mixers. The mixer engines are placed outside of the digester and are directly accessible, making maintenance of the system effortless.

Top components, best-of-class technology

Biogest uses plant components which have been optimized to process all types of waste and by-products, in addition to agricultural feedstock. Biogest operates as a manufacturer, design and construction contractor, biogas plant owner and operator, and uses its experience to provide only proven technology which assures a robust durability of the equipment and low maintenance costs on a long term basis.

Covering the entire value chain

Our cost-effective and resource-saving solutions, based on technically advanced designs, contribute to an environmentally friendly future by providing green and sustainable energy. The scope of Biogest services range from project feasibility studies, design development and business planning to turnkey construction and commissioning of plants.

Service and maintenance

Our clients also trust our expertise when it comes to operation and maintenance, for which we offer tailor-made service agreements. Our technical and biological service provides support after the construction and commissioning of your biogas plant is completed, to help you achieving excellent performance over the long-term. Our service package also includes regular plant inspections by our specialists, and training customer employees on how to operate their plants. Moreover, our eShop offers wear and tear parts needed for your daily operation that you can directly order from your computer or from the mobile phone app we have developed.

Our experience

Biogest has completed more than 170 projects on 3 continents and is able to provide tailored service due to its highly qualified international team. With more than 30 years of experience in the AD sector, we have optimized the process design of our plants to guarantee simple operation while achieving high reliability.

Headquarters

BIOQUADRAT Energie- und Wassertechnik Holding GmbH

THE ICON VIENNA Central Station
Gertrude-Froehlich-Sandner Straße 2-4
Tower 9, Floor 9
A-1100 Vienna, Austria

Contact

T +43 1 2260700
office@biogest.at
www.biogest.at

Worldwide Offices

BIOGEST®

Pars Marine Industry Co. (PMC) Official Representative of Biogest in IRAN

www.ParsMarineCo.com

PowerRing

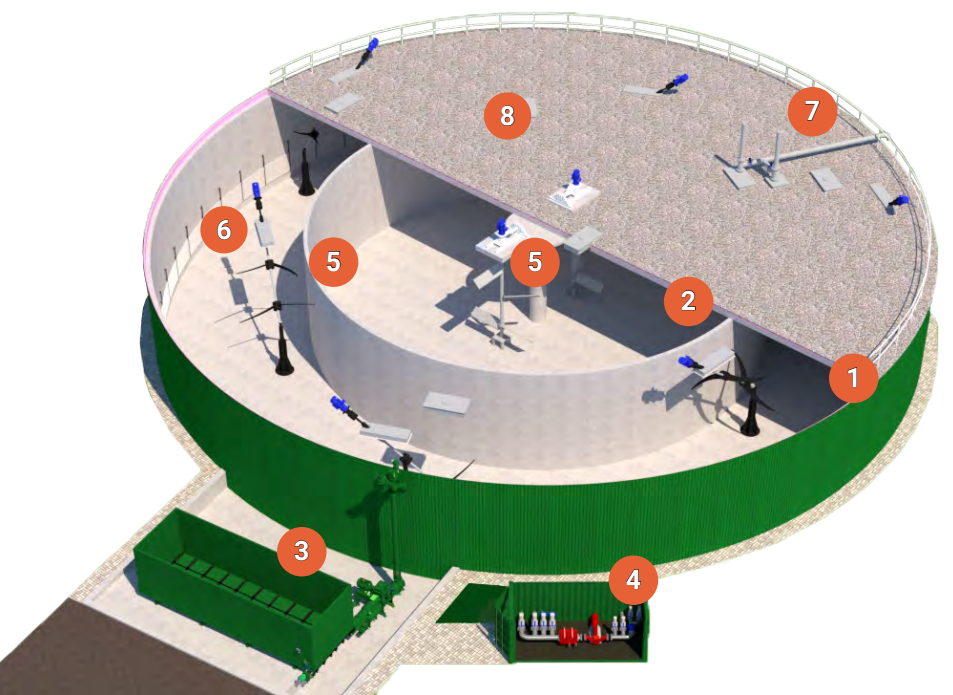
Technical Data Sheet

The Efficient Allrounder

Advantages

- High feedstock and dry matter flexibility
- Reduced heat loss and electrical consumption
- Allows for easy access to all equipment
- Simple maintenance
- Outstanding reliability and operational stability
- High total full load hours
- High degradation rates and therefore low feedstock consumption
- Standard designs ranging from 500 - 5,000 kW_{th} per module

The versatile PowerRing digester was developed as a modular tank-in-tank system to overcome all challenges of a modern biomethane or biogas plant.



1. Primary digester
2. Secondary digester
3. Feeding system
4. Central pumping station
5. Agitation system
6. Heating system
7. Pressure relief valve
8. Digester inspection port

Range of applications

The outer ring, being the primary digester of the PowerRing, is designed to fundamentally improve the mixing efficiency. In contrast to a classic tank design where complete homogenization of the digester volume can present operational challenges, the feedstock in the ring-digester is naturally led through the digester due to its channel-like shape. As a result, the PowerRing is suitable for a wide variety of feedstock including lignocellulosic feedstock with high dry matter that can be used and efficiently processed.

Proven, outstanding efficiency

Compared to first-generation biogas systems, PowerRing reference plants demonstrate the following scientifically proven advantages:

High degree of degradation

There is no substitute for digester volume. Up to 80% of the degradation takes place in the primary digester, while an optimum residual breakdown is ensured by low overall volumetric loading and selective biological activation of the secondary digester, resulting in lower feedstock costs.

Low energy consumption

With the PowerRing, the agitation system and digester geometry are perfectly matched, so that highly efficient mixing can be achieved while consuming less energy. Once the feedstock is fed into the digester, the overflow system works by gravitational flow through the two digestion stages, instead of pumping; this contributes to an even lower energy consumption. Heat losses can be minimized thanks to the thermally insulated digester cover. The plants are perfectly suited for use in continental climate conditions which are characterized by hot summers and cold winters, because the heat can be used for other purposes within farm or factory applications.

High performance numbers

More than 90% of full-load hours per year have been achieved at our reference plants. This result is attributable to the high level of availability, operational safety and our fully automated control system. The external gas storage facility enables early identification and automatic balancing of any fluctuations in gas production.

Mesophilic/Thermophilic Ring-in-Ring digester

The sizing of the PowerRing digester is based on recent scientific studies conducted at the University of Natural Resources and Life Sciences, Vienna (BOKU). The aim was to achieve a more stable and effective biological degradation process resulting in state-of-the-art biogas plants which have been proven with over 8,300 successful operating hours on more than 160 reference plants.

Top components, best-of-class technology

Biogest uses plant components which have been optimized to process all types of waste and by-products, in addition to agricultural feedstock. Biogest operates as a manufacturer, design and construction contractor, biogas plant owner and operator, and uses its experience to provide only proven technology which assures a robust durability of the equipment and low maintenance costs on a long term basis.

Various designs

The PowerRing standard plant is available in various standard designs with power outputs ranging from 500 to 5,000 kW_{th} (100 to 1,000 Nm^3 biogas/h) per unit. Combination of digesters and future expansion of existing facilities can be easily achieved due to the modular design of the plant. Given the unique situation and circumstances of each farm or company, Biogest will develop specific plant solutions to exactly meet your requirements regarding the feedstock availability, heat, electricity or methane demand at your site.

Covering the entire value chain

Our cost-effective and resource-saving solutions, based on technically advanced designs, contribute to an environmentally friendly future by providing green and sustainable energy. The scope of Biogest services range from project feasibility studies, design development and business planning to turnkey construction and commissioning of plants.

Service and maintenance

Our clients also trust our expertise when it comes to operation and maintenance, for which we offer tailor-made service agreements. Furthermore, we offer an eShop for our clients, where our customers can order spare and wear parts on a one-click basis via an app on your smartphone or desktop computer.

Headquarters

BIOQUADRAT Energie- und Wassertechnik Holding GmbH

THE ICON VIENNA Central Station
Gertrude-Froehlich-Sandner Straße 2-4
Tower 9, Floor 9
A-1100 Vienna, Austria

Contact

T +43 1 2260700
office@biogest.at
www.biogest.at

Worldwide Offices

BIOGEST®

Biogas/Biomethane Project - Questionnaire

Introduction

The aim of the following questions is to define key parameters of your biogas/biomethane project. After filling out the form, please either send the document to sales@biogest.at or to your direct contact person. With the information provided we will calculate key parameters like electrical power/heat generation or biomethane quantity, fertilizer output, overall dimensions, initial economic parameters and more.

We underline that this calculation is free of charge and does not involve any obligation from your side. The purpose of this form is to identify your potential biogas/biomethane generation capacity.

The initial evaluation does not require answering all the questions in the form. For a start the most important thing is to determine the type and the quantity of available feedstock. This will allow us to calculate the output of the biogas plant.

If you have any questions please do not hesitate to contact us.

1. Project

Name of project	
Contact Person	
Address	
Email	
Phone	
Installation place	

2. Project information

2.1. Project type

- ☐ Biogas/CHP (for electricity and heat purposes)
- ☐ Biomethane
- ☐ Other, please specify

In case electricity is not the target output:

- Is there external electricity available? ☐ YES ☐ NO
- Is there an external heat source (for digester heating) available? ☐ YES ☐ NO

2.2. Operation of the biogas/biomethane plant

- ☐ Operation of the biogas plant carried out internally by the agricultural company
- ☐ Operation of the biogas plant in a separate company (SPV) with secured feedstock contracts
- ☐ Other, please specify

2.3. Available area for the biogas/biomethane plant

m^2

Capacity for feedstock storage on site:

☐	YES	m^3
☐	NO	

How often will feedstock be delivered to the feeding system?
☐ 1 time per day ☐ 2 times per day

Premises (existing buildings that could be used for the installation of equipment):

☐	YES	m^2
☐	NO	

2.4. In case of biomethane, distance to gas grid

m

2.5. Substrates (livestock, agro-industrial by-products, energy crops, etc)

Substrates	Fresh material [tons / year]	Dry matter DM [%]	Organic dry matter (if known) oDM [%]

2.6. Digestate storage

Will digestate be separated?	☐	If selected, which technology?
Will **solid** be stored on site?	☐	If selected, storage time in days:
Will **liquid** be stored on site?	☐	If selected, see next question
• Residue tank	☐	If selected, storage time in days:
• Lagoon	☐	If selected, storage time in days:

3. Project stage – time schedule

		When
Project development	☐	
Planning - design	☐	
Authorization approved	☐	
Tender (if any)	☐	
Construction start	☐	

4. Agreements

	YES	NO
For feedstock deliveries	☐	☐
For methane offtake	☐	☐
For electricity offtake	☐	☐
For digestate offtake	☐	☐
For heat offtake	☐	☐
For site lease/ownership	☐	☐

5. Financing status

Select if you are still looking for a solution to cover any of the following elements

☐	Project development costs
☐	Equity
☐	Debt

6. Availability of project documents

1.
2.
3.

7. Comments