

# Renewable Energy from Biogas. Fully engineered power systems for landfill, waste water and agricultural gases.

Short payback. High availability. Reduced maintenance.



# 140 years of engineering



Founding of the "Mechanische Werkstätten" in Mannheim by Carl Benz and August Ritter.

1871



In 1880 Carl Benz produced his first gas engine.

1880



On January 29, 1886, German Patent no. 37435 for a patented motorcar is issued.

1886



Merger with Daimler-Motorenengesellschaft.

1926

## Our experience for your success

### **Strong partner for your progress**

With MWM you can benefit from 140 years of experience in gas engine technology and energy production. Since 2011 the traditional company, Motorenwerke Mannheim, has belonged to the worldwide network of Caterpillar Inc. This gives us an even more unique expertise that benefits you in the development of individual complete solutions.

### **Worldwide successful technology**

MWM offers you the confidence and experience of a specialist who has already successfully installed hundreds of biogas systems with gas power plants within and outside of the European region. Efficiency and reliability are the decisive factors everywhere.

### **Competent, reliable, and uncomplicated**

We want you to be satisfied with us in every phase of the project: That is why we clearly spell out all agreements in a written order confirmation with a detailed schedule. MWM stands for reliability and quality of planning, right down to commissioning.

### **We stick to our agreements**

If you put great value in an optimal return on your investment in a biogas system and smooth handling, MWM is a natural first choice. We offer comprehensive experience and always keep a close eye on the entire process. Seamless and turnkey ready – from initial consultation to handling the completed system by our customer service. We say what we do, and we do what we say.



Takeover of MWM by Klöckner-Humboldt-Deutz AG. From 2005 DEUTZ Power Systems.

Return to the traditional name of MWM. Expansion of international activities.

MWM becomes part of Caterpillar Inc.

MWM becomes Caterpillar Energy Solutions GmbH.

1985

2008

2011

2013



MWM TCG 2016

MWM TCG 2020

MWM TCG 2032

# Individually configured



Refrigerant module



Container



Active carbon filter



Catalysts

## Turnkey-ready systems solutions for all key gas types

### **Sustainable and environmentally sound**

Bio-energy produced locally by a cogen power plant (CHP) is more efficient than ever. The electricity produced can be used for a company's own energy supply, and the feed into the public grid provides for additional profits. Through individual configuration, the efficiency of your system can be significantly boosted even higher.

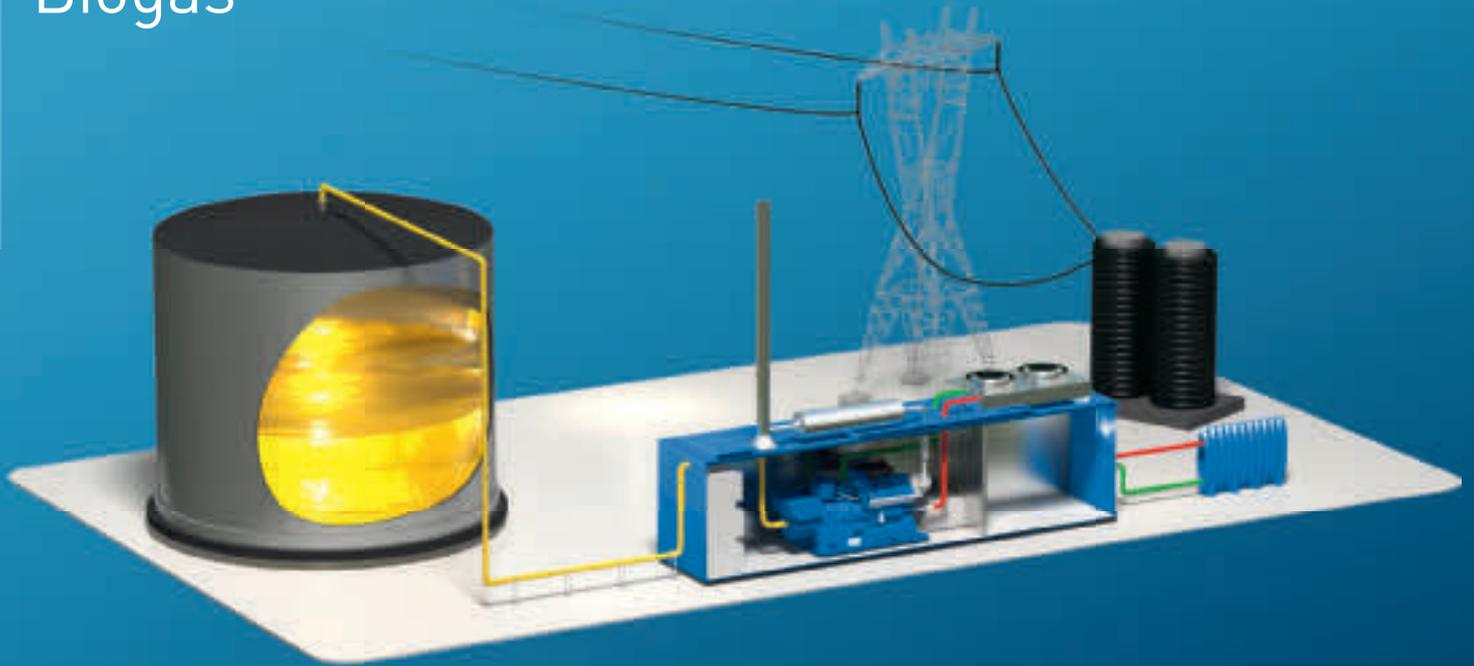
### **Ideally matched to your requirements**

Whether you need a new engine or a complete solution: With state-of-the-art technology expertise and the experience from 140 years of decentralized energy supply, MWM adapts its individual solution to the gas type, the infrastructure and the location of your company. Our biogas portfolio has the right answer for any task.

### **Future market of decentralized energy supply**

Given increasingly scarce resources during a time when energy demand is rising worldwide, decentralized energy supply offers clear advantages. As a worldwide leading specialist for power generation from gases, MWM is the professional partner for your project – also for the economical conversion of biological fermentation gases into electricity.

# Biogas



## Highest efficiency with biogas

### Derive maximum efficiency from your biogas system

During initial setup or engine refitting, each system is ideally configured to the properties of the gas produced. This provides a decisive edge in efficiency and ensures significantly optimized payback times.

### Comprehensive plant expertise

Worldwide over 2,000 gensets with biogas projects are in operation, with a total output of over 1,500 MW<sub>el</sub>.

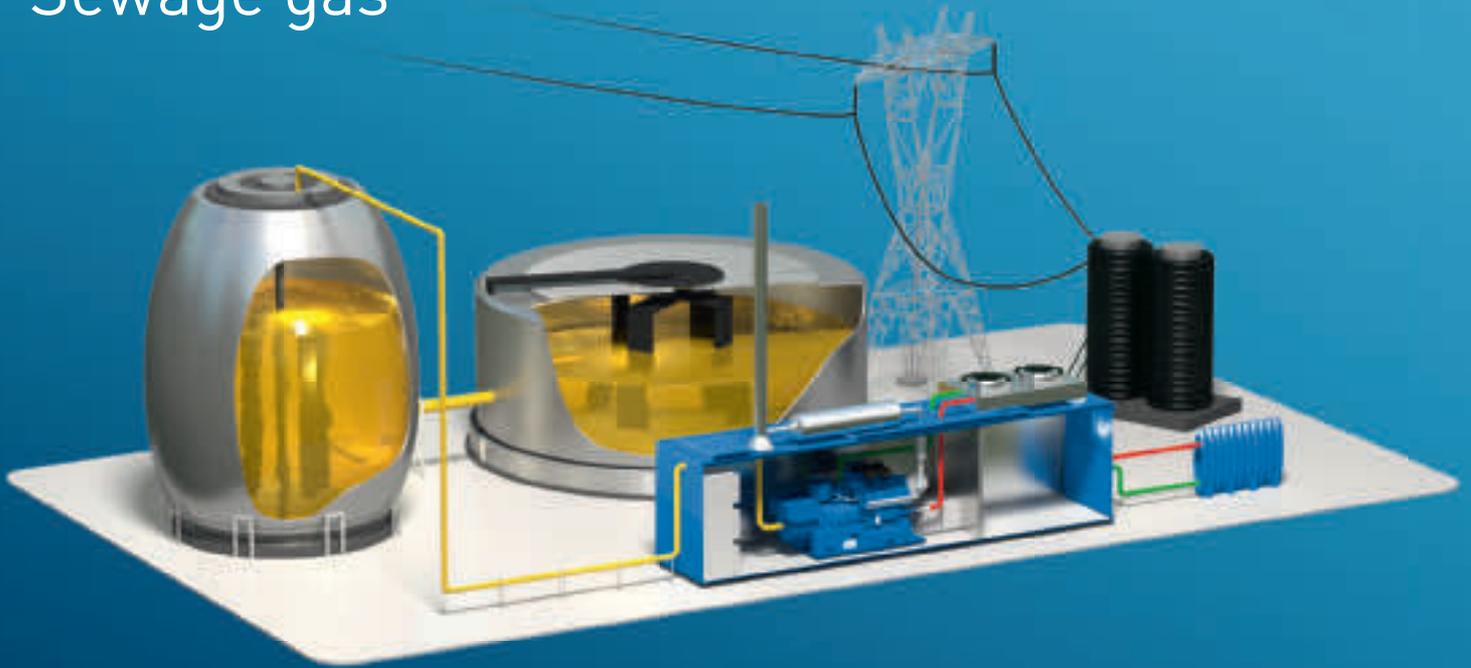
### Strengths of MWM biogas systems

Thanks to many years of experience and myriad references, MWM has in-depth knowledge on the most diverse types of requirements for biogas projects. Boasting a vast array of detailed solutions already configured, MWM is exactly the right partner for fulfilling your individual specifications.

### Your MWM advantages at a glance

- Comprehensive plant expertise
- Best quality in material and workmanship
- Impressively short payback times
- High availability thanks to extended maintenance intervals
- Economical and profitable electricity production
- Compliance with country specific usage regulations
- Quick, economical service

# Sewage gas



## Immediate readiness worldwide

### Ready for rapid commissioning

Thanks to comprehensive testing routines, MWM features ready-made solutions for challenging sewage gases with low methane content. That is why MWM gas engines are ideally configured to your gas, thus eliminating the need for elaborate adjustment processes.

### Detailed knowledge from successful sewage gas projects

Worldwide over 400 gensets are deployed in sewage gas projects, with a total output of over 300 MW<sub>el</sub>.

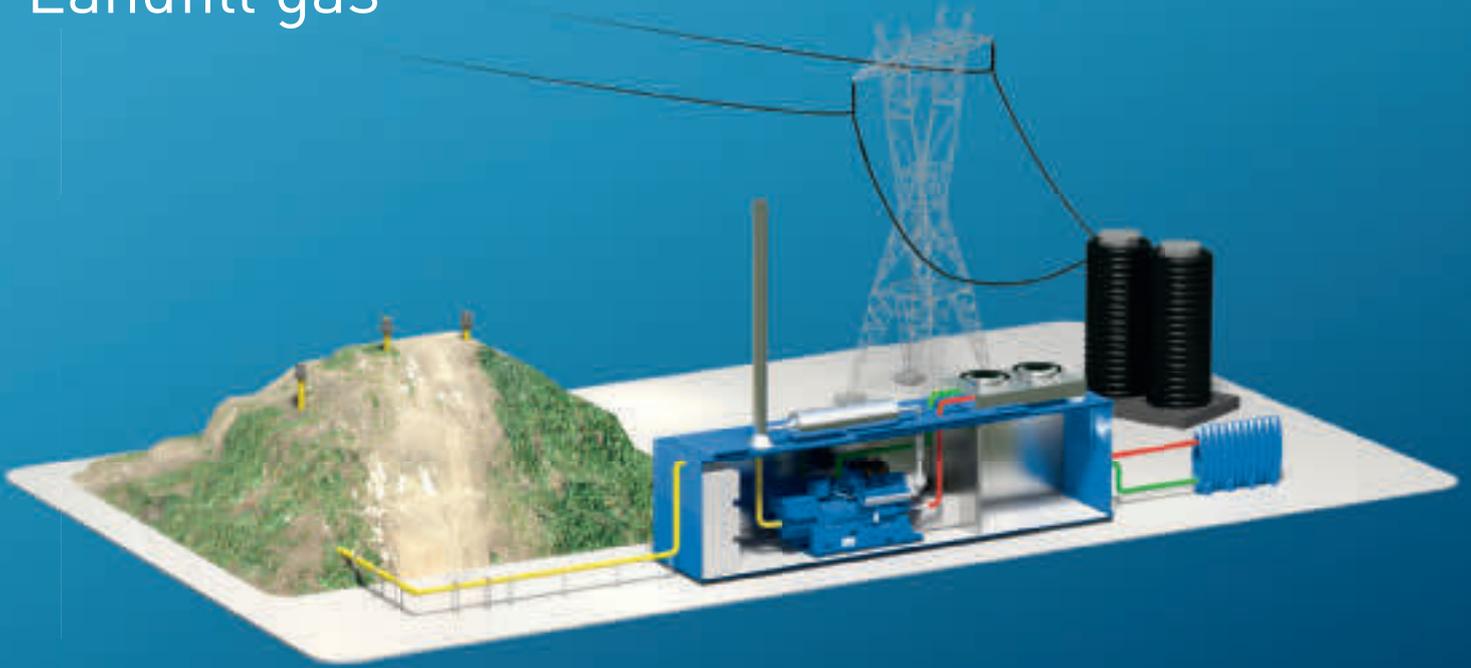
### International experience

Comprehensive industry knowledge for worldwide successful sewage gas projects and numerous international reference projects with the most diverse requirements make MWM a leading partner for long-term efficient sewage gas solutions.

### Your MWM advantages at a glance

- Integrated process heat generation for the sewage treatment plant
- Exceptional efficiency for optimal performance
- Extremely short payback times
- High availability and reliability
- Double climate protection:  
Recovery and usage of sewage gas;  
power generation and lowering of emissions
- Quick, economical service

# Landfill gas



## Ideally configured to your requirements

### Special components for smooth running

To utilize landfill gas or other gases that have a high CO<sub>2</sub> content, MWM uses pistons with a modified compression ratio. In addition, the proven MWM pre-chamber spark plugs provide for high efficiency and long service life.

### Many years of experience

Worldwide over 700 gensets are deployed in 400 systems with a total output of over 600 MW<sub>el</sub>.

### Professionals for landfill gas

Having completed several hundred international reference projects, we are experts for special requirements in landfill gas installations. Our highly efficient, completely engineered solutions make MWM a strong partner for landfill gases.

### Your MWM advantages at a glance

- Individual configuration for best efficiency
- Extremely short payback times
- Efficient solutions even for the lowest methane content
- High availability and reliability
- Issuing of CO<sub>2</sub> certificates based on lower emissions
- Environmental protection through the utilization of generated methane gases
- Quick, economical service

# Our technological competitive edge



## Your commercial success

### **Specially matched engine components**

Here is one example among many: Especially for the requirements of biogas, we have developed pistons with a higher compression ratio. They guarantee a more efficient use of resources and thus greater economy. Another contributing factor is the longer service life of components. This is achieved through utilization of sputter bearings and the installation of mixture coolers with nano-sealed fins.

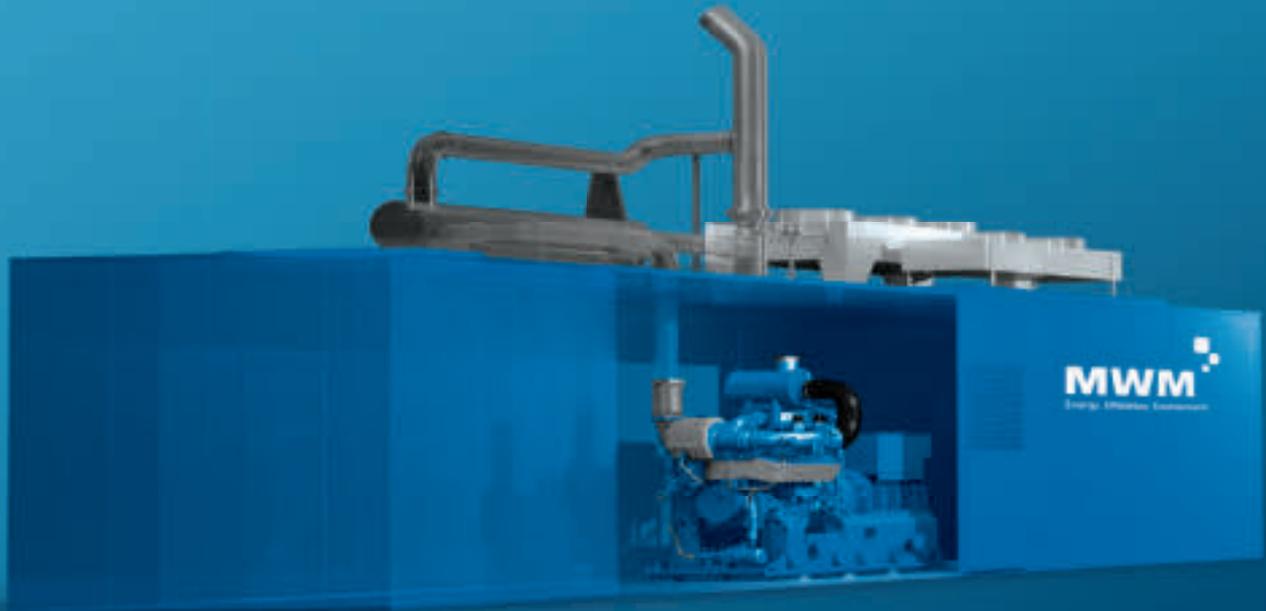
### **Reliable at low gas pressure**

MWM gas applications run with a very low gas inlet pressure and maintain high efficiency even under the toughest conditions. Our advanced systems do not require the use of energy sapping gas inlet compressors, thereby offering increased efficiency, simplified construction and reduced investment costs.

### **Complete solutions for compliance with emission limit values**

There are fully-designed complete solutions for all MWM gas applications with which you will be able to easily comply with emissions standards and take advantage of subsidies. Upstream gas processing technology and subsequent exhaust gas treatment are perfectly matched to the equipment of the MWM genset.

# MWM Container



## Everything under one roof

### Turnkey-ready for deployment

In containers from MWM, all the components are custom-matched. In addition, for quicker and thus more economical setup, the design of the roof configuration is optimized. MWM's service within the scope of a worldwide network is also part of the complete package.

### Top service included

- Deployable for natural gas, biogas, landfill gas, sewage gas, coal mine gas and other special gases.
- Planning, configuration, installation, service – all from one source and perfectly geared to your needs.
- Easy transport, quick setup.
- TEM remote diagnostics with direct online access to all current engine parameters during operation. This enables malfunctions to be diagnosed immediately.

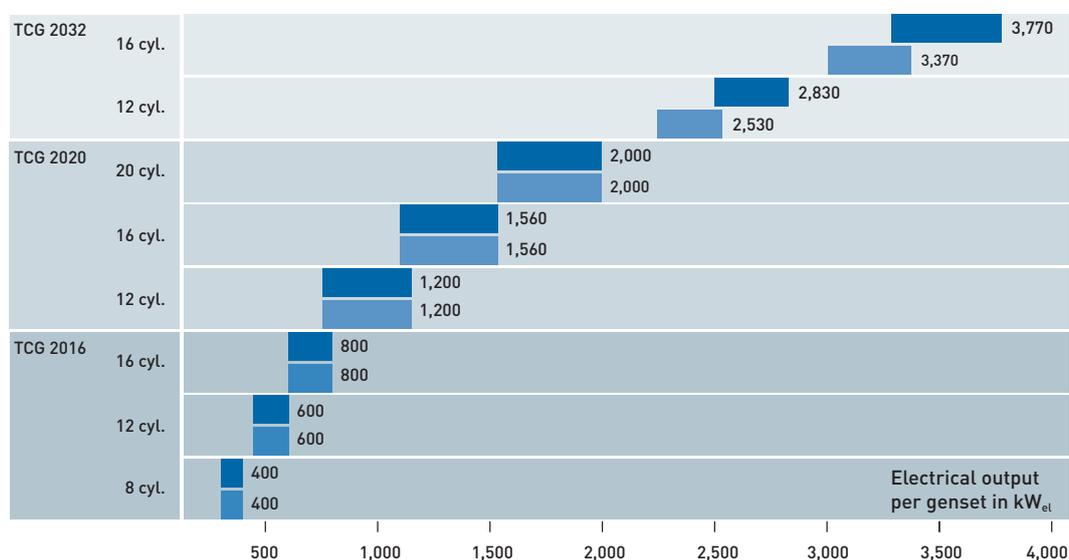
# Gensets for ecology and economy



## Efficiency for your commercial success

### MWM Gensets

The centerpiece of each MWM gas application is the extremely robust MWM genset. It features outstanding efficiency at low gas consumption, the highest level of economy, along with exemplary quality and optimal reliability. Thanks to our wide range of service options, you receive the most efficient solutions for your individual requirements.



With our gensets we can cover a power range from 400 kW<sub>el</sub> to more than 100 MW<sub>el</sub> for decentralized power production.

Legend: 50 Hz 60 Hz



# Continuously better

MWM generators undergo continuous improvement. You can obtain the latest output figures online.

MWM Engine Type TCG 2016 <sup>1)</sup>		TCG 2016 V08 C	TCG 2016 V12 C	TCG 2016 V16 C
Electrical power <sup>3)</sup>	kW	400	600	800
Mean effective pressure	bar	19.0	18.9	18.9
Thermal output <sup>2)</sup>	±8% kW	394	595	790
Electrical efficiency <sup>3)</sup>	%	42.8	42.7	42.8
Thermal efficiency <sup>3)</sup>	%	42.1	42.3	42.3
Total efficiency <sup>3)</sup>	%	84.9	85.0	85.1



1) Engine type 50 Hz in biogas operation. 2) Cooling of exhaust gases down to 120 °C for natural gas and 150 °C for biogas.  
3) According to ISO 3046/1 at voltage = 0.4 kV, cosphi = 1 for 50 Hz.

MWM Engine Type TCG 2020 <sup>1)</sup>		TCG 2020 V12 <sup>2)</sup>	TCG 2020 V16 <sup>2)</sup>	TCG 2020 V20 <sup>2)</sup>
Electrical power <sup>4)</sup>	kW	1,200	1,560	2,000
Mean effective pressure	bar	18.6	18.1	18.6
Thermal output <sup>3)</sup>	±8% kW	1,250	1,645	2,021
Electrical efficiency <sup>4)</sup>	%	42.0	41.7	42.9
Thermal efficiency <sup>4)</sup>	%	43.8	44.0	43.3
Total efficiency <sup>4)</sup>	%	85.8	85.7	86.2



1) Engine type 50 Hz in biogas operation. 2) Version optimized for island mode and adding loads.  
3) Cooling of exhaust gases down to 120 °C for natural gas and 150 °C for biogas. 4) According to ISO 3046/1 at voltage = 0.4 kV, cosphi = 1 for 50 Hz.

MWM Engine Type TCG 2032 <sup>1)</sup>		TCG 2032 V12	TCG 2032 V16
Electrical power <sup>3)</sup>	kW	2,830	3,770
Mean effective pressure	bar	17.0	17.0
Thermal output <sup>2)</sup>	±8% kW	2,734	3,460
Electrical efficiency <sup>3)</sup>	%	42.3	42.9
Thermal efficiency <sup>3)</sup>	%	40.8	39.4
Total efficiency <sup>3)</sup>	%	83.1	82.3



1) Engine type 50 Hz in biogas operation. 2) Cooling of exhaust gases down to 120 °C for natural gas and 180 °C for biogas.  
3) According to ISO 3046/1 at voltage = 11 kV, cosphi = 1 for 50 Hz.

The specifications in these data sheets are for information purposes only and do not represent binding values. The specifications stated in the quotation are definitive.

# Everything from one source – worldwide



## For service quality from the beginning

### **Assessment of needs and consultation**

Everything begins with a non-binding request for quotation, which MWM produces within just a few business days. After a preliminary discussion with a detailed assessment of technical requirements, we develop in-depth planning documents for your biogas system. This is individually tailored to your requirements, wishes and precise specifications.

### **Mounting and assembly**

If all permits have been obtained and the planning documents have been completed to the full satisfaction of all parties, the layout and assembly of your system is scheduled. Working with a team of carefully chosen subcontractors, we manage the entire process. A detailed project plan specifies the tasks to be handled by MWM and those to be assumed by you.

### **Putting the system into operation**

As soon as your MWM genset has been assembled on site, the startup phase begins. Upon successful completion of the startup phase, your system can be put into operation. It typically takes no longer than six months from the placement of order to the moment in which your system is ready for operation.

## Maintenance and customer service with MWM original parts

Our quality service with MWM original parts ensures you optimal output during a maximum life cycle. On request, we guarantee maximum availability of your MWM systems through a complete maintenance contract – including all maintenance procedures and remote inspections. Our customer service technicians operate worldwide. This includes your area, too.



### Your MWM advantages at a glance

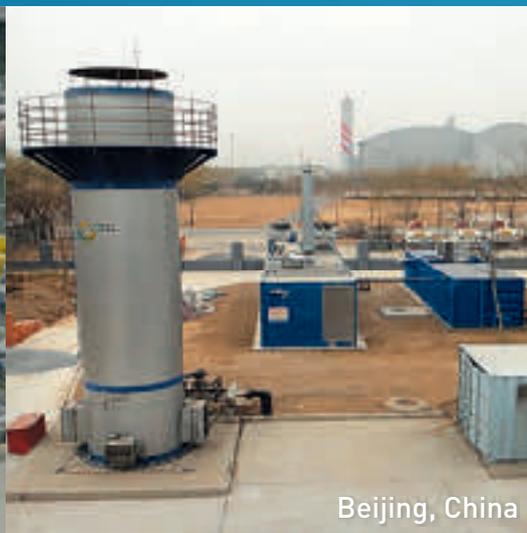
- Emergency service – 24h full geographic coverage
- Remote diagnostics – precise and competent
- Original parts – with warranty
- Spare parts supply – quick and reliable
- Service personnel – qualified and trained
- Certified – according to ISO 9001, 14001 and BS OHSAS 18001
- Always up-to-date – with the latest parts version

Find out more at <http://www.mwm.net/en/services>

# More than 2,000 systems



Melbourne, Australia



Beijing, China



Ämmässuo, Finland

## Deployed successfully everywhere

### Melbourne Water, Australia

The Melbourne Water Corporation is in charge of waste water disposal and treatment for the city's 3.7 million inhabitants. Seven gas engines convert natural gas and sewage gas into electricity, thus creating 1.4 MW at a temperature of 35 °C. The thermal output is also 1.4 MW per engine.

7 x MWM TBG 620 V16 K | Commissioning: 2002

### GaoAnTun Landfill Beijing, China

The project at the GaoAnTun landfill began in the year 2007 with the installation of a TCG 2016 V12B with an output of 537 kW<sub>el</sub>. Based on the good experiences with this genset, the customer decided in 2008 and 2009 to install three additional MWM gensets, thus increasing his system to a current 2,874 kW<sub>el</sub>.

2 x MWM TCG 2016 V12B in the Container | 1 x MWM TCG 2016 V12C in the Container | 1 x MWM TCG 2020 V12 in the Container | Commissioning: 2007

### Landfill Ämmässuo, Finland

The 50 hectare landfill in Ämmässuo is the world's first landfill gas system with engines from the TCG 2032 series. Here the landfill gas produced from waste fermentation is utilized in four TCG 2032 V16 units. MWM dealt with the low calorific value of the gas by installing a gas control unit for each bank of cylinders. This was a project that in 2012 won Finland's National ENERGY GLOBE Award.

4 x MWM TCG 2032 V16 | Commissioning: 2010



Dukyang-gu Goyang City, Korea



Méne, France



Mannheim, Germany

### **NanJi Water Recycle Centre, Korea**

The Korea District Heating Corp. is one of the largest district heating providers in the world. The TCG 2020 V16 gensets put into operation in early 2013 each have an electrical output of some 1.6 MW. The units are part of the first system installed in South Korea to generate electricity and heat from biogas.

2 x MWM TCG 2020 V16 | Commissioning: 2013

### **Biogas system Méne, France**

The biogas system in Brittany/France uses pig manure and industrial sludges and greases to produce 700 m<sup>3</sup> of biogas per hour. The special feature of this system is the complex conditioning to irrigate an adjacent willow plantation. The heat of both MWM TCG 2016 V16 units is completely utilized.

2 x MWM TCG 2016 V16 in the Container | Commissioning: 2011

### **Sewage treatment plant Mannheim, Germany**

The sewage treatment plant Mannheim is expanding its inventory of plants by one container with a MWM TCG 2020 V12. This new system is operated in two-gas mode with natural gas and sewage gas. The heat generated is used for heating the sewage treatment towers, thus reducing the energy costs of the sewage treatment plant considerably.

1 x MWM TCG 2020 V12 in the Container | 1 x MWM TBG 616 V16 | 3 x MWM TBG 620 V12 K  
Commissioning: 2009

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[www.mwm.net/en/mwm-worldwide](http://www.mwm.net/en/mwm-worldwide)

