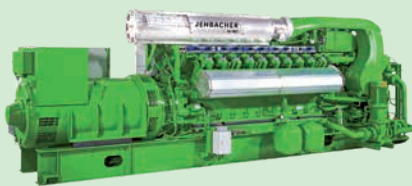


JENBACHER

OUR SOLUTION FOR
MORE EFFICIENCY:
PURE WASTE.



Jenbacher landfill gas solutions
from INNIO – your gas engine expert

**ENERGY SOLUTIONS.
EVERYWHERE, EVERY TIME.**



LANDFILL GAS AS AN ENERGY SOURCE

Landfill gas is created during the decomposition of organic substances in Municipal Solid Waste (MSW). Depending on the landfill design and its management, as well as waste composition, compaction, moisture and several other factors, thousands of landfills are available worldwide to collect and utilize this valuable energy source for power generation.

LANDFILL GAS COLLECTION

For a landfill restoration that prevents greenhouse gas from migrating into the atmosphere while avoiding offensive smells and smoldering fires, the gas must be continuously extracted under controlled conditions. Perforated tubes are drilled into the landfill body and interconnected by a pipe work system. Using a blower, the gas is sucked from the landfill. A well-designed gas collection system will flexibly capture the gas from various spots and handle high temperatures, leachate, condensates and air content – thus ensuring a cost-efficient collection as well as stable gas quality. Several engineering companies specialize in this field and offer their services on a worldwide basis.

AMOUNT AND COMPOSITION OF LANDFILL GAS

Municipal waste contains 330 to 550 pounds (150 to 250 kg) of organic carbon per ton, which microorganisms convert into landfill gas through an anaerobic process. The gas formation is influenced by a number of factors such as waste composition, landfill storage height and density, air temperature, atmospheric pressure and precipitation levels. Decomposition starts one to two years after the waste is deposited in the landfill and lasts 15 to 25 years. The continuously decreasing gas volume can be compensated by the disposal of additional waste during this period.

With a calorific value of 340 to 530 BTU/square feet (3,5 to 5,5 kWh m³_N), landfill gas constitutes a high-value fuel for gas engines that can be effectively used for power generation:

Methane (CH₄) <small>(methane has 21 times the global warming potential of CO₂)</small>	35% – 55% BY VOL.
Carbon dioxide (CO₂)	30% – 44% BY VOL.
Nitrogen from air (N₂)	5% – 25% BY VOL.
Oxygen from air (O₂)	0% – 6% BY VOL.
Water vapour (H₂O)	saturated

Consequently, 1 million tons of municipal solid waste generate about 60 to 90 million square feet (1.7 to 2.5 million m³) of collectable methane, enough to fuel a gas engine capacity of 850 to 1,250 kW producing 6,500 to 10,000 MWh electricity per year. That roughly corresponds to the average power demand of 1,800 to 2,800 EU households.

THE JENBACHER CONCEPT

The broad range of Jenbacher* landfill gas engines is specially designed to run at full load with high efficiency, despite a low heating value and fluctuations of gas quality and pressure. The high quality and specially designed engine parts resist the impurities that usually appear in this type of fuel.

Before the landfill gas can be fed into the gas engines, it needs to be dried and compressed. Severe contaminants such as siloxanes should be removed if exceeding a certain level. Not only will these measures considerably increase the availability, but they also will reduce the operating and maintenance costs for the engine. Since landfills are usually located near big cities, emission standards are becoming more and more rigid in many countries. To comply with those standards, the whole system must be managed, beginning with the fuel gas conditioning up to the installation of an exhaust treatment device, if needed.

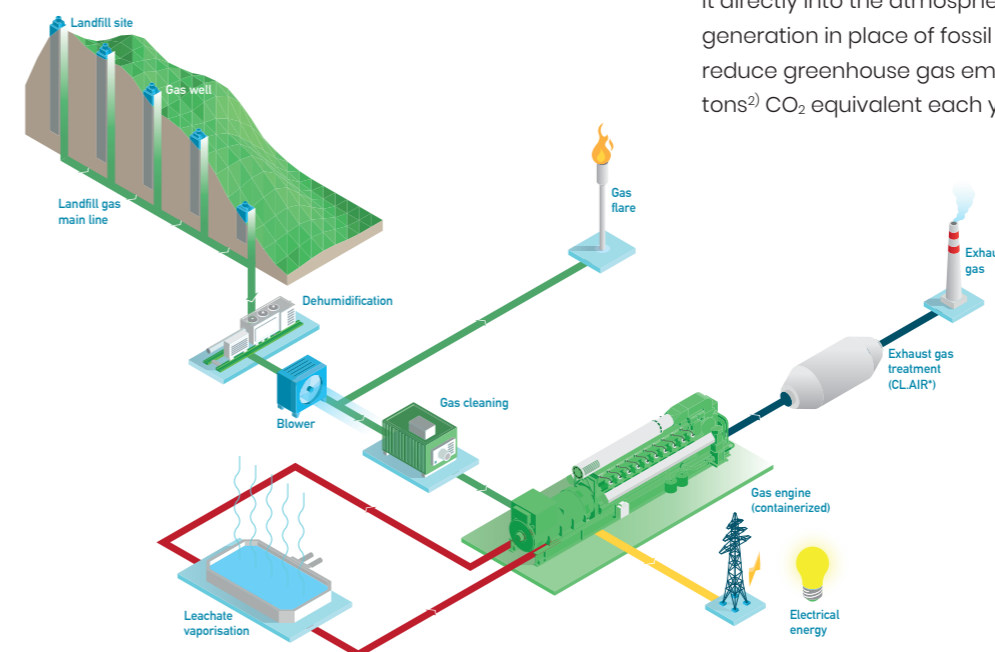
INNIO* is committed to not only supplying its Jenbacher gas engines, but also offering auxiliary equipment and giving support for an integrated solution – from the gas flange to the grid connection.

ADVANTAGES

- Smooth operation despite low heating value and fluctuations in gas composition and pressure
- Electrical efficiency of up to 44.7%, and up to 90% efficiency in the case of combined heat and power
- Low weight containerized units that are easy to move and adjust to changing project capacity
- Basic design and support for gas conditioning, if required
- CLAIR*: Integrated exhaust aftertreatment solution complying with country-specific standards
- Flexible Contractual Service Agreements
- Alternative disposal of a problem gas while simultaneously harnessing it as an energy source
- Revenues for power (and heat) production, when fed into the public grid
- Carbon credits for reduction of methane releases or special renewable energy tariffs

OUR COMPETENCE

With more than 30 years of experience in the combustion of landfill gas – and more than 2,400 landfill gas systems with a total electricity output of about 2,500 MW delivered throughout the world – the Jenbacher product team offers an unparalleled breadth of expertise, references and solutions. These plants have the potential to generate about 19 million MW-hours of electricity a year – enough to supply more than 5.5 million EU homes.¹⁾ In addition, by capturing landfill gas instead of emitting it directly into the atmosphere and using it for power generation in place of fossil fuels, these engines can reduce greenhouse gas emissions by about 68 million tons²⁾ CO₂ equivalent each year.



¹⁾ Based on average electricity consumption of households in EU, 2014, World Energy Council <https://wec-indicators.enerdata.net/>
²⁾ Based on 2017 global data on carbon density of power generation, IEA <https://www.iea.org/tracking/tcep2018/power/>

INNIO* is a leading solutions provider of gas engines, power equipment, a digital platform and related services for power generation and gas compression at or near the point of use. With our Jenbacher* and Waukesha* product brands, INNIO pushes beyond the possible and looks boldly toward tomorrow. Our diverse portfolio of reliable, economical and sustainable industrial gas engines generates 200 kW to 10 MW of power for numerous industries globally. We can provide life cycle support to the more than 50,000 delivered gas engines worldwide. And, backed by our service network in more than 100 countries, INNIO connects with you locally for rapid response to your service needs. Headquartered in Jenbach, Austria, the business also has primary operations in Welland, Ontario, Canada, and Waukesha, Wisconsin, US.

For more information, visit: [innio.com](https://www.innio.com)

Image front page: Landfill Wernsdorf, 2015
Image author: Firma Helicolor Luftbild Ost GmbH
Landfill operator: Berlin Cleaning Service

*Indicates a trademark

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