

**Clarke  
Energy®**

Engineer - Install - Maintain



| Landfill Gas

*Renewable Power*  
From Waste Gas

**JENBACHER**  
**INNIO**

Distributor New Units & Services

# Landfill Gases

Clarke Energy is a multinational specialist in distributed power generation technology. Our scope ranges from the supply of a gas or diesel fuelled power generation engine, through to the turnkey installation of a multi-engine power plant. Clarke Energy is an authorised distributor and service provider for INNIO's Jenbacher gas engines. The business has a strong focus on aftersales support; developing in-country resources to service and maintain our facilities, along with original equipment manufacturer approved spare parts. Our aim is to provide high quality products and installations supported by a reliable, accountable and localised after-sales service. Integrity is a core company value and Clarke Energy operates to the highest international standards of compliance.

## Benefits of working with Clarke Energy

- Quality products, balance of plant and installations products mean high technical and environmental performance hence maximum returns for our customers.
- Our installations are backed up by the highest levels of localised aftersales support, meaning maximum reliability of the power generation assets we supply.
- Extensive engineering experience across a range of gases and applications, meaning tailored, optimal power generation solutions for our customers

## Landfill Gas

Landfill gas is created during the anaerobic decomposition of organic substances in municipal solid waste (MSW), commercial and industrial (C&I) wastes and other biodegradable waste streams. Depending upon 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 utilise this valuable renewable energy source for power generation. If landfill gas is allowed to escape to atmosphere, methane contained within it is a powerful greenhouse gas, 21 times more so than carbon dioxide. Therefore, its prevention of escape to atmosphere and its utilisation as a renewable fuel source is a win-win situation.

## Benefits of Landfill Gas Power

- Production of renewable power
- Avoidance of greenhouse gas emissions
- Cost effective, proven technology

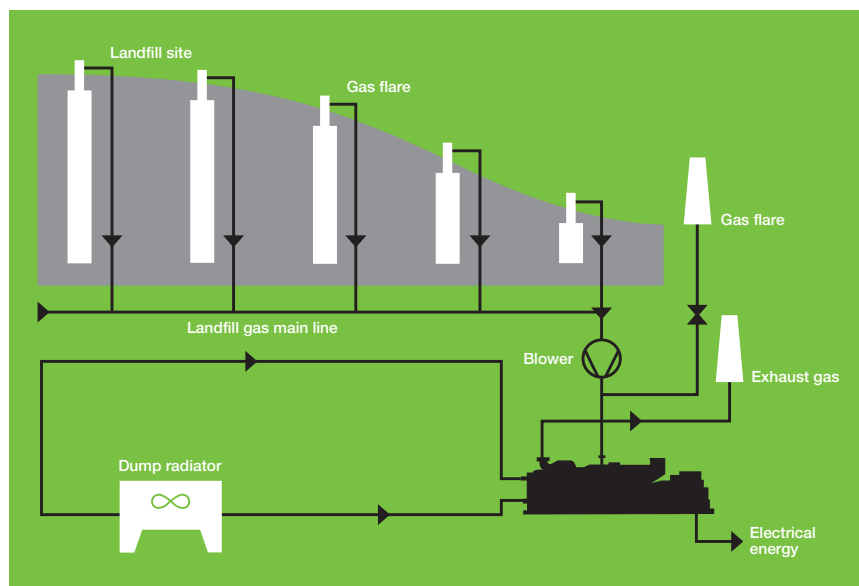
## Landfill Gas Collection

For a landfill restoration that prevents greenhouse gas from migrating into the atmosphere while avoiding offensive smells and smouldering fires, the gas must be continuously extracted under controlled conditions. Perforated tubes are drilled into the landfill body and interconnected by a pipework 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 specialise in this field and offer their services on a worldwide basis.

Arbois, France, 3 x JGC420



Landfill Gas Schematic



Quantity and Composition of Landfill Gas

MSW contains 150-250 kg of organic carbon per tonne which micro-organisms convert to landfill gas via anaerobic decomposition. 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. Gas production starts one to two years after the waste is deposited in the landfill and lasts 15-25 years. The continuously decreasing gas volume can be compensated by the disposal of additional waste during this period.

With a calorific value of 3.5 to 5.5 kWh Nm³ (35-55% methane), landfill gas constitutes a high-value fuel for gas engines that can be effectively used for power generation.

Component Composition (by volume)	
Methane (CH4)	35-55%
Carbon dioxide (CO2)	50-35%
Nitrogen (N2)	5-25%
Oxygen (O2)	0-6%
Water vapour	saturated

Consequently, 1 million tonnes of MSW generate 1.7-2.5 million m³ of collectable methane, enough to fuel a gas engine capacity of 850-1,250 kW<sub>e</sub> producing 6,500 to 10,000 MWh of electricity per year. That roughly corresponds to the average power demand of 1,500-2,200 EU households.

Jenbacher & Landfill Gas

The broad range of Jenbacher landfill gas engines is specifically designed to run at full load with high efficiency and high availability, despite a low heating value and fluctuating gas quality and pressure. The high quality and specially designed engine parts resist the impurities that usually appear in landfill gas and similar types 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 of the generator, but they will also reduce the costs associated with operation. Since landfills are usually located near big cities, emission standards are becoming more and more ridged in many countries. To comply with these standards, the whole system must be managed, beginning with the fuel gas conditions up to the installation of an exhaust treatment service, if needed.

Please request a fuel gas quality specification to understand operational limits for gas contaminants in the generator's fuel.

Clarke Energy is committed to not only supplying the 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 42%, and up to 90% efficiency in the case of combined heat and power
- Low weight containerised units that are easy to move and adjust to changing project capacity
- Basic design and support for gas conditioning if required
- Flexible long-term contractual maintenance agreements available
- Revenues for power and heat production when fed into the public grid.
- Carbon credits for reduction of methane releases or special renewable energy tariffs
- Additional systems for the removal of siloxanes from the gas are available. Please request information on temperature swing absorption (TSA)
- CL.AIR: Integrated exhaust after-treatment solution complying with country-specific standards

Our Competence

Clarke Energy has installed and commissioned a multitude of landfill gas generation equipment globally and is one of the leading players in its field. Globally Jenbacher units are applied in thousands of landfill gas systems with a high output of megawatts. The Clarke Energy and Jenbacher product teams offer an unparalleled breadth of expertise, references and solutions.

These plants generate about 11 million MWh of electricity annually, enough to supply more than 2.7 million EU homes. In addition, by capturing landfill gas instead of emitting it directly into atmosphere and using it for power generation in place of fossil fuels, these engines can reduce greenhouse gas emissions by about 40 million tonnes CO<sub>2</sub> equivalent each year. The amount of greenhouse gas emission savings equals the annual emissions related to nearly 22 million EU passenger cars.

Lymington Landfill, Vindor, UK, 1 x JGC420

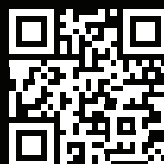


Henderson Waste, Australia, 2 x JGC320



Clarke Energy, a Rehlko Company, is a multi-award-winning global business specializing in the engineering, installation and maintenance of distributed energy solutions.

Clarke Energy supplies a range of different energy efficient, resilient, low carbon and renewable power generation and storage technologies. For gas based projects we are able to produce or accept renewable and low carbon fuels including hydrogen, biogas and biomethane / renewable natural gas (RNG).



To contact Clarke Energy  
please visit our website:  
[www.clarke-energy.com](http://www.clarke-energy.com)