GE Energy

waste is pure energy

using landfill gas in Jenbacher gas engines

GE imagination at work

GE Energy

BASCHNEGGER AMMANN PARTNER

GE Energy's gas engine business is one of the world's leading manufacturers of gas-fueled reciprocating engines, packaged generator sets and cogeneration units for power generation. It is one of the only companies in the world focusing exclusively on gas engine technology.

Jenbacher engines range in power from 0.25 to 3 MW and run on either natural gas or a variety of other gases (e.g., biogas, landfill gas, coal mine gas, sewage gas, combustible industrial waste gases).

A broad range of commercial, industrial, and municipal customers use Jenbacher products for on-site generation of power, heat, and cooling. Patented combustion systems, engine controls, and monitoring enable its power generation plants to meet the strictest international emission standards, while offering high levels of efficiency, durability, and reliability.

GE Energy's Jenbacher product team has its headquarters, production facilities, and 1,000 of its more than 1,250 worldwide employees in Jenbach, Austria.

GEA-13720A

for more information on Jenbacher products

Austria (Headquarters)
Achenseestraße 1-3
A-6200 Jenbach
T +43 5244 600-0
F +43 5244 600-527
E info@gejenbacher.com
www.gejenbacher.com

Denmark
Industrivej 19
DK-8881 Thorsø
T +45 86966788
F +45 86967072

Germany
Amselstraße 28
D-68307 Mannheim
T +49 621 77094-0
F +49 621 77094-70

Hong Kong
15 Floor, The Lee Gardens
33 Hysan Avenue Causeway Bay
T +852 2100 6976
F +852 2100 6630

Italy
Via Crocioni, 46/H, Casella Postale n. 41 Aperta
I-37012 Bussolengo (VR)
T +39 045 6760211
F +39 045 6766322

Spain and Portugal
Avda. del Camino de lo Cortao, 34 – Nave 8
E-28700 San Sebastián de los Reyes (Madrid)
T +34 916586800
F +34 916522616

The Netherlands
Stationspark 750
NL-3364 DA Sliedrecht
T +31 184 495222
F +31 184 415440

United Arab Emirates
Dubai Airport Free Zone, W 1, Suite 220
PO Box 54338, Dubai
T +971 4 2996678
F +971 4 2996679

USA
15855 Jacinto Port Blvd
Houston, TX 77015
T +1 281 8642765
F +1 281 8642506

GE imagination at work

landfill gas as energy source

Landfill gas is created during the decomposition of organic substances and consists of methane (CH_4), carbon dioxide (CO_2) and nitrogen (N_2). Uncontrolled venting of landfill gas hampers or prevents rapid, scheduled recultivation of a landfill site. To prevent this and to avoid offensive smells, smouldering fires or the migration of gas, the gas must be continuously extracted under controlled conditions. With a calorific value of approximately 5 kWh/Nm^3, landfill gas constitutes a high-value fuel for gas engines that can be effectively used for energy generation.

creation of landfill gas

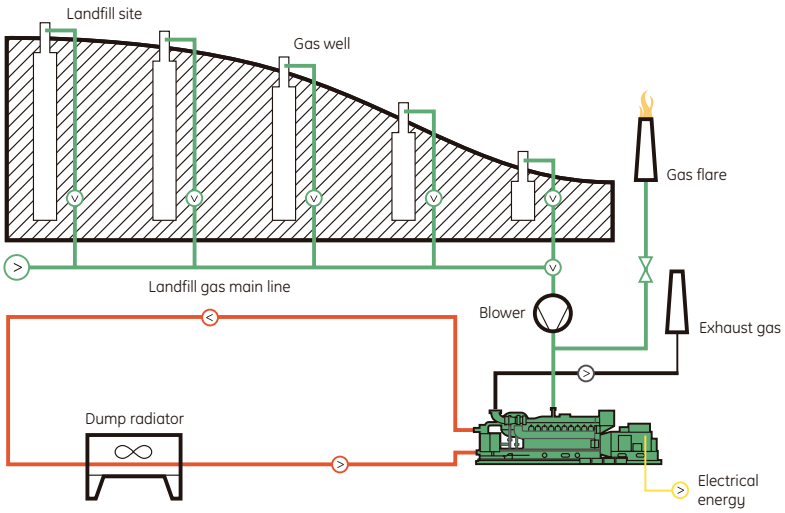
Household waste contains approximately 150 to 250 kg of organic carbon per ton. These substances are biologically degradable and are converted by micro-organisms into landfill gas in the absence of air. Stable, anaerobic methane fermentation begins 1 to 2 years after the waste is deposited in the landfill.

If the landfill gas is collected constantly and in a controlled fashion, the following average values are achieved after the gas collection process has been properly adjusted:

Methane (CH_4)	approximately 40 – 50% by volume
Carbon dioxide (CO_2)	approximately 35 – 45% by volume
Nitrogen from air (N_2)	approximately 5 – 15% by volume
Oxygen from air (O_2)	approximately 1 – 3% by volume
Water vapour (H_2O)	saturated

the Jenbacher concept

Perforated tubes are drilled into the landfill body and interconnected by a pipe work system. Utilizing a blower, the gas is sucked from the landfill, compressed, dried and fed into the gas engine. For safety reasons, the installation of a gas flare is recommended so that excess gas can be burned off in the event of excessive gas production. In most cases all the electrical power generated is fed into the public grid.



volume and production process figures

Gas formation is influenced by a number of factors such as the landfill material, the storage height and density of the landfill material, water content, air temperature, atmospheric pressure and precipitation levels. The decomposition process in a landfill providing gas with sufficient methane content lasts approximately 15 – 25 years, with the gas volume decreasing continuously over the years.

$G_r = G_e \times (1 - 10^{-k \times t})$	Volume of landfill gas produced
k	Decomposition constant (approximately 0.03 – 0.06)
t	Time in years
$G_e = 1.868 \times Co\ (0.014 \times d + 0.28)$	The gas volume formed over long time periods in m^3/t waste
d	Temperature in °C (20 – 40°C)
Co	Share of organic carbon in kg/t of waste (household waste: approximately 200 kg/t)

One ton of household waste produces approximately 150 – 200 Nm^3 of landfill gas with a methane content of approximately 50 – 60% in a time period of 15 to 25 years. An average household waste landfill with a utilized storage capacity of 500,000 tons can be expected to generate about 8.5 million Nm^3 of landfill gas per year, corresponding roughly to an energy content of 42 GWh. From this volume of gas, approximately 16 GWh of electricity or 20 GWh of heat can be generated per year – that corresponds roughly to the demand of 6,500 households.

advantages

- Problem waste gas is converted to an energy source
- Methane (CH_4) releases into the atmosphere are reduced or eliminated. The climate relevant effect (Global Warming Potential, GWP) of methane is 21 times higher than that of CO_2
- Landfill gas presents an alternative to conventional fuels
- Highly efficient for power generation with gas engines

our competence

We have the ideal solution for efficiently utilizing landfill gas. With more than 25 years of experience in the combustion of landfill gas and currently more than 950 landfill gas systems with a total electrical output of over 900 MW installed throughout the world, the Jenbacher product team offers an unparalleled breadth of expertise, references and solution variants.