



Alternative energy fuels

> Turn waste fuels into economical and environmentally responsible electric power

Our energy working for you.™



**Power
Generation**

What was waste is now a valuable source of energy. Alternative gaseous fuels can be used to produce electricity economically with enhanced gas generator set technology.



A total energy solution

Today, electric utilities as well as owners of landfills, biogas plants, wastewater treatment plants, coal mines and other waste fuel sources are all recognizing the energy potential of alternative gaseous fuels. What used to be waste has become a valuable source of energy that can be used for the economical production of electricity using low- and variable-energy-content gas generator set technology.

Cummins Power Generation helps you meet the demand for reliable electric power in a way that is both economical and environmentally friendly. As energy solution specialists, we design, build and maintain on-site power generating plants that produce electricity by harnessing waste fuels—“free” energy sources such as landfill gas, biogas, coal seam methane, flare gas and more.

A total energy solution...

Scottish landfill turns methane into electricity

Landfill-gas-to-energy (LFGTE) projects are becoming increasingly popular as companies and municipalities seek to generate “green power” to protect the environment and meet emissions requirements. One such project is operating in the United Kingdom (UK) with the help of a turnkey power system from Cummins Power Generation.

Viridor Waste Management, one of the UK’s largest operators of municipal landfills, manages a 193 acre site east of Edinburgh, Scotland. It handles tons of domestic waste daily, in a safe and environmentally friendly manner. Viridor captures the methane created by decaying waste, and uses two gas generator sets from Cummins Power Generation to produce 3.5 MW of electricity. The power is then sold directly to a nearby cement plant.



Cummins Power Generation provided a turnkey power system including generator sets with switch-gear and paralleling controls, fuel treatment for the landfill gas, mechanical and electrical design and the power plant building. The two 1750 kW generator sets operate in parallel.

As the landfill grows and methane production increases, two additional generator sets will be installed to produce a total of 7 MW. At current “tipping” rates, the landfill is expected to operate for the next 30 years.

A wide range of applications

Gas-powered generator sets and on-site power plants from Cummins Power Generation are specifically designed to run on non-pipeline gas with a low or variable energy content. These dilute methane mixtures can be sourced from:

> **Solid waste landfill gas:** More than 50 percent of landfill materials are organics and suitable for anaerobic digestion that yields biogas, typically about 50 percent methane.



> **Municipal sewage digester gas:** Untreated wastewater in municipal and industrial treatment plants creates digester gas containing 65-75 percent methane.

> **Agricultural wastes biogas:** Animal and plant waste from businesses like crop farms can be used to generate power.

> **Coal mine methane:** Naturally occurring in coal deposits, methane is trapped within these deposits until released by mining or drilling.

> **Flare gas:** Flammable gases and vapors previously disposed of by combustion in the open atmosphere can be used as an alternative fuel.

Burning methane in a generator set makes smart use of all these waste fuel sources and, at the same time, can significantly reduce the impact of power generation on our environment. And it's cost effective.

that's good for the environment

Australian coal seam methane producer powers local grid

Coal seam methane—gas that is trapped in a coal seam—is indistinguishable from natural gas and can be collected for use in all natural-gas applications.

One such project is in Moranbah, a coal mining town in central Queensland, where the generating plant produces electrical energy for its own gas processing facility and also sells power to the local grid. To power the processing plant, Cummins Power Generation supplied a 12 MW power station to Ergon Energy, the producer in Moranbah, located about two hours' drive inland from Mackay.

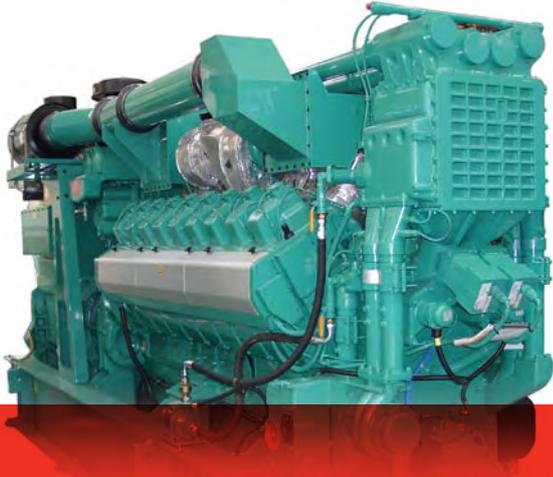
Cummins Power Generation won the supply contract for eight 1570 kW generating sets powered by a Cummins QSV81 engine plus an MC300 control system. The generators are especially suited to the



methane-burning application because of the reliable response of the engines' fuel system to the amount of energy contained in the fuel. Cummins Power Generation's scope of supply was for generators and commissioning, with reliability, fuel consumption and power guarantees written into the contract. The local Cummins distributor provides maintenance for the power plant.

Engine technology suited to alternative fuels and today's emissions standards

Ultra-lean-burn technology, coupled with engine enhancements specific to the demands of non-standard fuels, make Cummins Power Generation gas generator sets ideal for alternative fuel applications. Spark-ignited gas engines are sensitive to fuel factors such as calorific value, methane number and flame speed. These factors can vary widely in alternative fuels. The engine has to cope with fuels that can contain lower proportions of combustible hydrocarbons



and higher proportions of inert gases. Alternative fuels can also contain corrosive contaminants that could potentially damage engine components such as bearings and running surfaces.

To overcome engine performance issues associated with alternative fuels—and meet stricter engine emissions standards taking effect in Europe and the United States—Cummins engines are enhanced with electronic control and mapping technology that minimizes the effects of burning variable fuels. An advanced combustion system design burns alternative fuels efficiently at reduced temperatures and pressures for low volatile organic compound (VOC) and nitrogen oxide (NOX) levels. Carbon monoxide (CO) emissions and unburned hydrocarbons are minimized by complete combustion of the ultra-lean homogeneous fuel-air mixture.

The result is a gas-powered generator set that, already proven in power plant installations on all continents, is now uniquely suited to burning alternative fuels economically and with maximum environmental responsibility.

and good for the bottom line.

Canary Islands garbage treatment plant turns waste into energy

Located in the Atlantic Ocean, off the northwestern coast of Africa, the Spanish Canary Islands are home to the Salto del Negro municipal green household waste treatment plant. The plant handles up to 75,000 tons of biowaste per year, processing garbage collected from Las Palmas de Gran Canaria, a city of 380,000, as well as from several surrounding towns and villages.

Biogas (65 percent methane and 35 percent CO₂) produced by the waste plant's digestion process is used to power a cogeneration system from Cummins Power Generation. The combined heat and power system (CHP) transforms the biogas into electricity and heat. The exhaust heat from the engines is used by the treatment plant to develop the anaerobic processes in the digesters, while the



electricity surpluses are sold to the local utility—earning a biogas-sourced electricity premium.

The Salto del Negro installation consists of low energy content generator sets, a PowerCommand® Digital Master Control and low-voltage switchgear, all built by Cummins Power Generation. Cummins Power Generation also supplied balance-of-plant equipment such as radiators and heat exchangers, as well as installation supervision and commissioning of the generator sets.

A world map is shown in a dark red color against a lighter red background with a grid of latitude and longitude lines. The map is centered on the Atlantic Ocean, showing North and South America on the left and Europe and Africa on the right.

Close by and ready to serve you

Cummins Power Generation brings you alternative fuels technology where you want it, and how you want it. We can deliver a build-own-operate (BOO) power plant or provide application design, installation and project management for a turnkey power plant. No matter what your power need, a distributor from our global network of more than 130 countries is close by and ready to deliver an innovative power solution for you.

from a company ready to serve you.

More than alternative fuel solutions

We develop customized solutions to meet your energy needs, whether for continuous, peaking, combined heat and power or an alternative fuels application. We work with you to develop power plants that combine our centralized “factory” knowledge with our distributors’ local knowledge and proximity. Serving mainly the gas-fired, mid-power, distributed generation market in the 2 MW to 20 MW range, our solutions include:

- > System design
- > Project management
- > Turnkey power plant development
- > Financing
- > Maintenance contracts
- > Operations management

Asia Pacific

10 Toh Guan Road
#07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

Brazil

Rua Jati, 310, Cumbica
Guarulhos, SP 07180-900
Brazil
Phone 55 11 2186 4195
Fax 55 11 2186 4729

China

8 Wanyuan Street
Beijing Economic and
Technological Dev. Area
Beijing 100176
P.R. China
Phone 86 10 6788 2258
Fax 86 10 6788 2285

**Europe, CIS,
Middle East and Africa**

Manston Park Columbus Ave.
Manston Ramsgate
Kent CT 12 5BF
United Kingdom
Phone 44 1843 255000
Fax 44 1843 255902

India

35A/1/2, Erandawana
Pune 411 038
India
Phone 91 020 6602 7525
Fax 91 020 6602 8090

Latin America

3350 Southwest 148th Ave.
Suite 205
Miramar, FL 33027
USA
Phone 1 954 431 5511
Fax 1 954 433 5797

Mexico

Eje 122 No. 200 Zona Industrial
San Luis Potosí, S.L.P. 78395
Mexico
Phone 52 444 870 6700
Fax 52 444 824 0082

North America

1400 73rd Ave. NE
Minneapolis, MN 55432
USA
Phone 1 763 574 5000
USA Toll-free 1 877 769 7669
Fax 1 763 574 5298

Our energy working for you.™

www.cumminspower.com

© 2007 Cummins Power Generation Inc. All rights reserved.
Cummins Power Generation and Cummins are registered
trademarks of Cummins Inc. "Our energy working for you." and
PowerCommand are trademarks of Cummins Power Generation.
Printed in the U.S.A. F-1581 (07/07)

