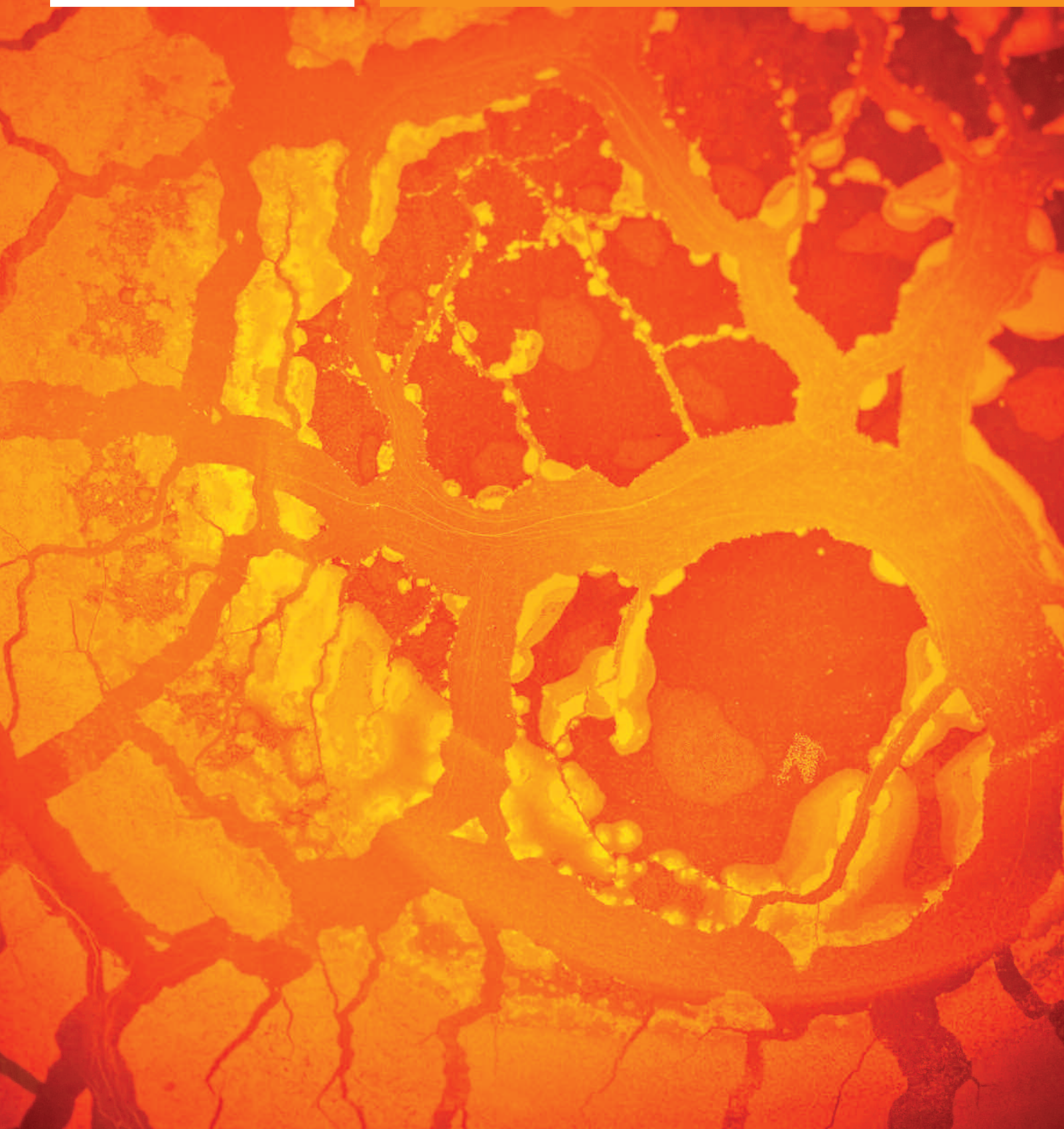
Clarke Energy

Engineer - Install - Maintain

Distributor & Service Provider
Gas Engines

Furnace Gas

Coke Gas
Blast Furnace Gas
Converter Gas



Furnace Gas

Clarke Energy is the authorised distributor and service partner for GE Energy's gas engine division in a growing number of countries across the world. In addition to providing high-efficiency, reliable gas engines we combine this with the expertise and resources to deliver unbeatable product support.

Whether your requirement is for the supply of a single gas engine generator or a complete turnkey power generation facility, we can meet that need. Our ability to add value by offering an end-to-end service, from initial proposal to reliable long-term maintenance, has led to us becoming a multi-national company with operations in ten countries across the globe. Our company prides itself on integrity, delivering only the highest quality products whilst providing a reliable accountable localised service.

Benefits of working with Clarke Energy
Clarke Energy provides flexible solutions for your gas generation projects. Our services range from the supply of a gas engine generator, through to the complete turnkey installation of a gas powered generation facility. Clarke Energy has a dedicated, top-quality team of sales, engineering, project management, commissioning and maintenance staff to meet your needs. We also offer long-term maintenance contracts backed up by a strong balance sheet, giving peace of mind with respect to the long-term performance of your GE gas generation equipment.

Power from Steel Production Gas

High levels of power requirement and rising energy costs represent a major challenge for the steel industry. Gases created as a 'free' by-product during steel production processes serve as an attractive energy source option for efficient power generation. In addition to the economic benefit, using these gases as engine fuel reduced industrial CO_2 emissions and saves natural energy sources.

Benefits of Power from Steel Production Gas

- Higher revenues from the utilisation of steel production gas as a fuel
- Reduced carbon emissions
- Stable robust onsite power supply
- Heat from engines can be used in other processes

Different Gases from Steel Production Processes

Steel production processes typically dispose large volumes of speciality gases. Three different process stages – from coal to steel – provide three different gas types: coke gas, blast furnace gas and converter gas.

Coke Gas

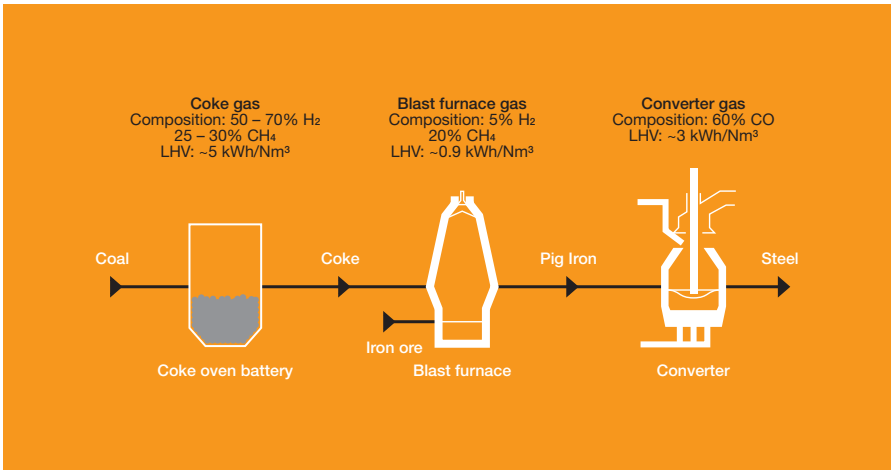
A by-product of industrial coke production from pit coal, coke gas is created by high-temperature dry distillation of coking coals in the absence of oxygen. The gas mainly consists of hydrogen (50-60%), methane (15-50%) and a small percentage of carbon monoxide, carbon and nitrogen. With a calorific value of 5kWh/Nm^3, coke gas constitutes a high-value fuel for effective power generation with GE Jenbacher gas engines

Blast Furnace Gas

Blast furnace gas is a by-product of blast furnaces where iron ore is reduced with coke into metallic (pig) iron. The gas has a very low heating value of around 0.9kWh/Nm^3, which on its own is typically not high enough for combustion in a gas engine. There is the possibility to blend this gas with other off gases; you should contact your local Clarke Energy office to discuss this in more depth.

Steel production gas type	Coke Gas	Blast Furnace Gas	Converter Gas
Source	Coke oven battery	Blast furnace	Converter
Input	Coal	Coke & Iron Ore	Pig Iron
Output	Coke	Pig Iron	Steel
Hydrogen %	50 - 70%	5%	–
Methane %	25 - 30%	–	–
Carbon monoxide %	–	20%	60%+
Lower heating value kWh/Nm^3	~5.0	~0.9	~3

Steel Production Gas Schematic



Converter Gas

Converter gas is created from pig iron during the steel production process. Steel-making technology can be categorised into two different processes: blow moulding or open hearth.

Within the blow moulding process, the pig iron is refined with oxygen or air, lowering the carbon proportion and providing enough process heat to maintain the steel liquid. With 60% of the worldwide raw steel production, the Linz-Donawitz (LD) process, classified as a blow moulding process, is the most common production method to generate raw steel.

On the other hand, the open hearth process extracts the oxygen of the added scrap and ore, requiring additional heat supply for the steel-making process. One of the most common open hearth processes is the electrical melting process.

Converter gas from the LD and electrical melting processes can be used in GE Jenbacher gas engines. The gas consists of about 65% carbon monoxide, 15% carbon dioxide, 15% nitrogen and small amounts of hydrogen and methane.

Concept

Varying compositions, as well as calorific values and the combustion behaviour of the gases from steel production processes, put greater demands on engine design. Clarke Energy offers specially modified GE Jenbacher gas engines that make efficient use of these gases for combined generation of heat and electricity.

In general, the stable composition of coke gas makes it advantageous as an engine fuel. The high hydrogen content of coke gas however, means the combustion process is very fast, which increases the danger of engine knocking or backfiring. To avoid this risk, GE has created an engine control system that is able to fuel the GE Jenbacher engine with a very lean mixture and, at the same time, react very quickly to variations in the engine load.

Converter gas, with its high carbon monoxide content, has low combustion speed and is very harmful. GE has developed the specific Jenbacher gas engine combustion system that allows burning the gas efficiently and reliably. Additionally, we offer a safety technology package that allows firm handling of harmful gases such as carbon monoxide.

Both gases can be used to create hot water, steam and electricity. The hot water and exhaust gases from the engines are fed into boilers. The resulting steam can be used within the steel production processes. Electricity generated by the GE Jenbacher engines can either be used on-site or sold to the public grid. Converter gas electrical efficiencies of up to 37% can be achieved, and coke gas efficiencies are even higher.

Advantages

- Independent power supply
- Reduced energy costs, and greater predictability and stability
- Efficient and economic combined heat and electricity supply
- High electrical efficiency compared to other power generation technology (i.e. steam or gas turbines)
- Best suited for an electrical output range of a few hundred kW up to 20-30MW
- Considerably low gas pressure required
- Alternative disposal of a problem gas while simultaneously harnessing it as an energy source
- Substitute to conventional fuels
- Environmental benefits by greenhouse gas reduction

Key Figures

Per tonne of coke that is produced, approximately 470Nm^3 of coke gas are produced. 60% of this volume is typically needed for internal processes; the remaining part can be used for power generation with GE Jenbacher gas engines resulting in approximately 400kWh

Per tonne of steel produced through the LD process approximately 50Nm^3 of converter gas are released which can burn in GE Jenbacher gas engines leading to approximately 50kWh electrical power.

Our Competence

Clarke Energy has comprehensive experience with gas engine technology and has a large reservoir of knowledge with respect to handling tricky gases such as steel production gas.

Substantial research has been completed on the steel gas application. Jenbacher installed its first commercial gas engine applications for coke gas in 1995 and for LD converter gas in 2004.

About 30 GE Jenbacher gas engines now run on either coke gas or LD converter gas. Underscoring GE's technical expertise, these units recently reached a combined total of more than 1 million operating hours. In addition, by utilising these 'free' waste gases compared to using natural gas for power generation, the GE Jenbacher technology-equipped sites have achieved CO_2 savings of about 2 million tonnes since commissioning.

Profusa coke gas project, Spain, 12 x JMS316

Posco steel gas project, Mexico, 1 x JMS620

If you would like to find out more about how Clarke Energy can help you develop your steel production gas project, please contact your local office for more details.

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