

**Clarke**  
**Energy**<sup>®</sup>  
A KOHLER COMPANY

Engineer - Install - Maintain

# Syngas

Synthetic Gas  
Synthesis Gas  
Wood Gas  
Pyrolysis Gas  
Producer Gas





# Syngas

Clarke Energy, a Kohler company, 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

## Power from Syngas

Syngas, also known as synthesis gas, synthetic gas or producer gas, can be produced from a variety of different materials that contain carbon. These can include biomass, plastics, coal, municipal waste or similar materials. Historically town gas was used to provide a gas supply to many residences in Europe and other industrialised countries in the early 20th Century.

Syngas is created by the gasification or pyrolysis of carbonaceous materials. Gasification involves subjecting these materials to high temperatures, in the controlled presence of oxygen with only limited combustion to provide thermal energy to sustain the reaction.

Gasification can occur in man-made vessels, or alternatively could be conducted *in-situ* as in the gas of underground coal gasification.

Where the fuel to the gasifier is of recent biological origin, such as wood or organic waste, the gas produced by the gasifier is considered to be renewable and so is the power produced by its combustion. When the fuel to the gasifier is a waste stream, its conversion to power in this manner has the combined benefit of the conversion of this waste into useful products.

## Benefits of Synthetic Gas

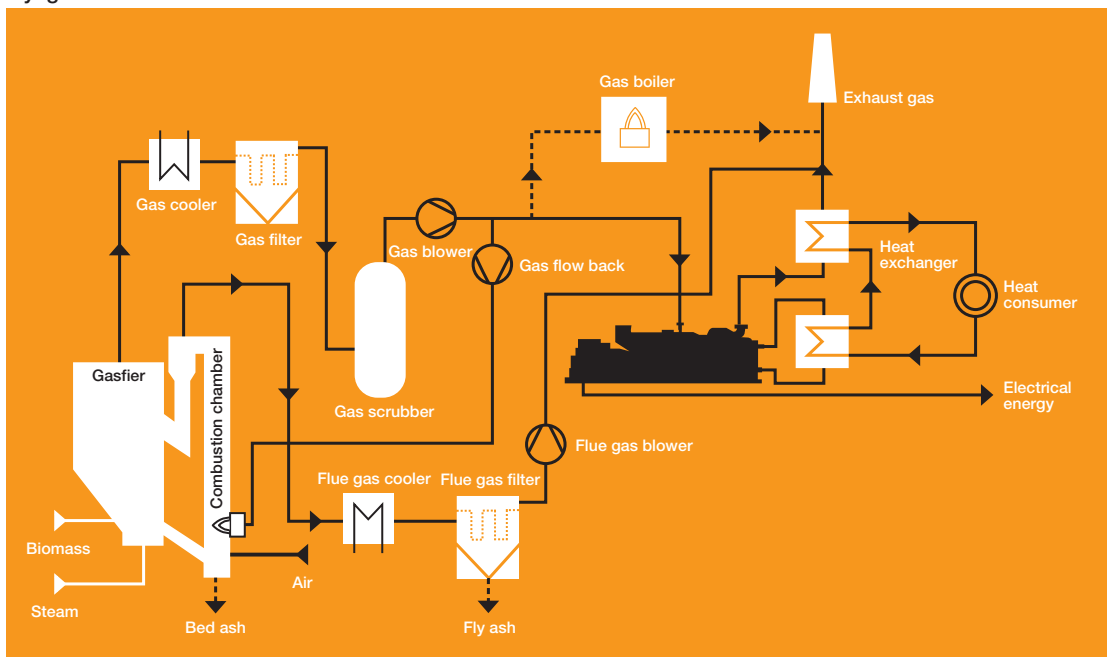
- Generation of renewable power
- Conversion of problematic wastes to useful fuels
- Economical onsite power production and reduced transmission losses
- Reduction in carbon emissions

## Syngas Challenges

The composition of syngas is highly dependent upon the inputs to the gasifier. A number of the components of syngas cause challenges which must be addressed at the outset, including tars, hydrogen levels and moisture.

Hydrogen gas is much quicker to burn than methane, which is the normal energy source for gas engines. Under normal circumstances, faster combustion in the engine cylinders would lead to the potential of pre-ignition, knocking and engine backfiring. In order to counter this challenge the engine has a number of technical modifications and the output of the engine is reduced to between 50-70% of its typically natural gas output. (I.e. a 1,063kW engine running on natural gas is comparable to a maximum 730kW engine on synthetic gas).

Syngas Schematic



## Syngas Composition

Substance	Composition (%)
H <sub>2</sub>	20-40
CO	35-40
CO <sub>2</sub>	25-35
CH <sub>4</sub>	0-15
N <sub>2</sub>	2-5

## Fuel Gas Quality

A wide range of hydrogen gases can be used in gas engines. However as with all engine fuels, there are specific limits to different components the input fuel gas. Gas contaminants in syngas, most notably tar and humidity, are a key technical challenge to the utilisation of synthetic gases. Please request the special gas technical instruction for fuel gas quality for more information.

## Concept

Varying compositions, as well as calorific values and the combustion behaviour of the gases from synthetic gases processes, put greater demands on engine design. Clarke Energy offers specially modified Jenbacher gas engines that make efficient use of these gases for combined generation of heat and electricity. Special features of these engines may include flame arrestors for the prevention of backfiring, special gas mixers to improve gas mixing and to be more robust to dirt.

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

Some synthetic gases have a high carbon monoxide content, which has a low combustion speed and is very harmful. Jenbacher has developed the specific gas engine combustion system that enables burning of the gas efficiently and reliably. Additionally, Clarke Energy & Jenbacher offer a safety technology package that allows firm handling of harmful gases such as carbon monoxide.

Syngas 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 other localised industrial processes. Electricity generated by the Jenbacher gas engines can either be used on-site or sold to the public grid. Syngas electrical efficiencies of 37% and over can be achieved with Jenbacher gas engines

## 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 from a few hundred kW up to 20-30MW
- 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

## Our Competence

Clarke Energy has comprehensive multi-national experience with gas engine technology and has a large reservoir of knowledge with respect to handling tricky gases such as syngas.

Jenbacher engines are known for its flexibility and robustness when utilising difficult gases. Coupling this with a maintenance agreement with Clarke Energy will enable you to get the highest performance from your generator.

Güssing, Austria, wood gas project, 1 x JMS 620



Yamagata, Japan, wood gas project 1 x JMS612, 1 x JMS 616

