# Qalovis Q-PowerGen System

## Technical information

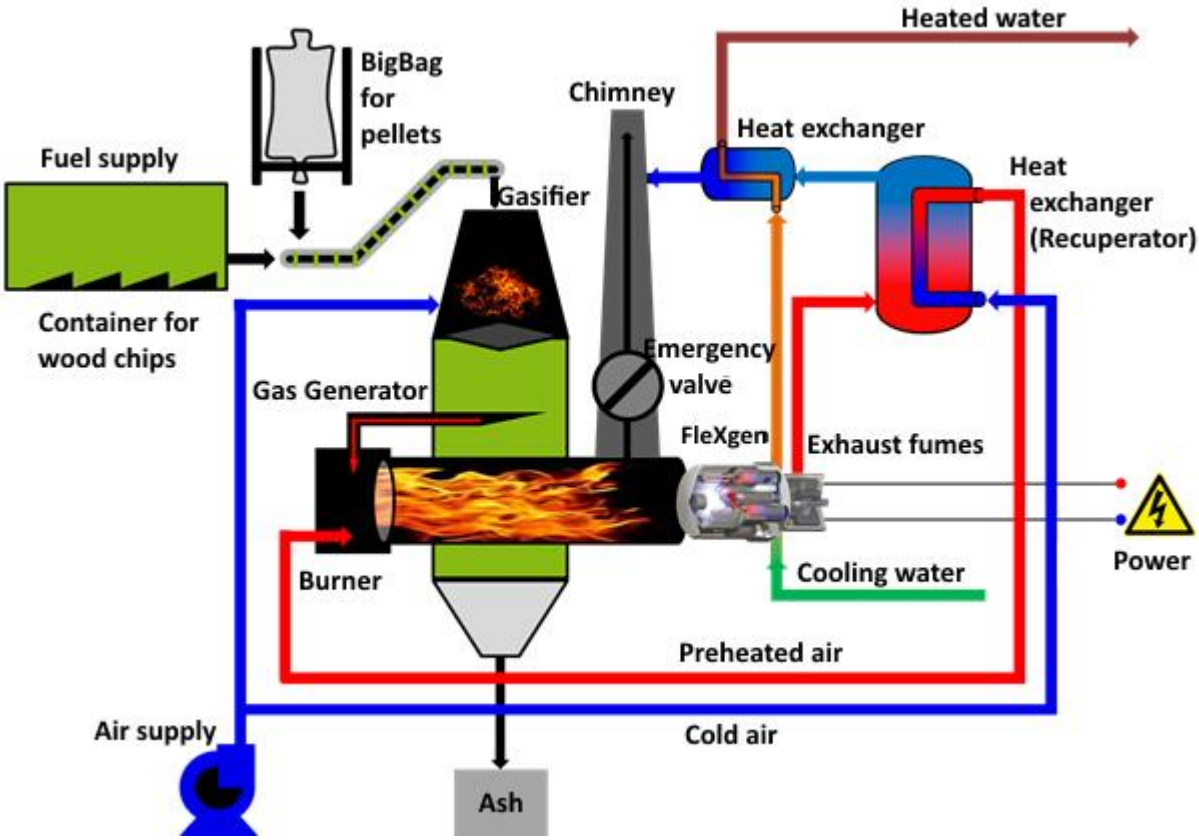
**Manufacturer/Supplier**

**Qalovis** GmbH
*Boschstrasse 18*
48341 **Altenberge** – Germany

**Short description:**

The Qalovis Q PowerGen system is a Stirling engine based biomass Gasification CHP for parallel generation of heat and electricity.
It produces in steady state operation 36 kW electrical and 120 kW thermal Power (kW el and kW therm).

**Layout of the basic structure:**



**Delivery and Scope of supply:**
Q PowerGen system consisting essentially of gasifier VHG 30,
air supply, recuperator, exhaust heat exchanger, burner and combustion chamber,
Hot gas duct, Stirling generator unit FleXgen G38 and control via PLC.

**Functional description:**
The biomass solids CHP can use biomass in form of wood chips and pellets.
The chips can be supplied over a sliding floor container and pellets via a BigBag station.
With a tubular chain conveyor the product reaches the upper end of the reactor/gasifier.
There the fuel will be dropped from the tube chain conveyor and falls over
a feed chute into the gasification fixed bed reactor. The chute is superimposed of
the Barrier gas air principle. Also a slider, which is opened only for the charging process,
prevents in a standard case the exit of producer gas upwards into the chute.
With a level sensor inside the fixed bed reactor the loading operation will be initialized
and terminated.

At different heights the air will be supplied to the fixed-bed reactor.
After one single electric ignition of the gasification process the Gasification process runs autotherm. The fixed bed lays on a riddling grate which is driven time pulsed.
Ash and generator gas will be distributed to the lower part of the reactor,
there the ash will be separated and discharged from the reactor by screw conveyors (level sensor controlled). The gas is removed from the reactor via the so-called gas guide tube and supplied to the burner.

This burner is mounted in front of the combustion chamber, which crosses the lower part of the reactor. In the burner uncooled generator gas will be mixed and burned to about 400 °C Temperature level by means of preheated air. At the back end of the combustor 1000 °C can be achieved.
This hot gas stream then impinges on the heat exchanger head of the Stirling engine, which extracts the heat from hot gases and convers them first into mechanical work
A generator is ultimately seated on the driven shaft, it converts the mechanical energy into electrical energy.

The exhaust gases of combustion are cooled in the Stirling up to app. 600 °C and then enter the recuperator in which it is further cooled.. While the burner supply of Combustion is supplied to the exhaust gases pass again an air-water
Heat exchanger and exit via the exhaust fan the plant towards the chimney.

A supply air fan with an "air tree" said air distributor ensures on the
entrance side for the supply of the gasification and the combustion air,
but ensures on the other hand the required air flows for cooling and the capacity
of air needed as safety air.

The heat extraction from the system is carried out through the cooling water of the Stirling and secondly through the already mentioned air-water heat exchanger in the exhaust stream behind the recuperator.

A special feature of the system is the so-called "emergency chimney": in the case of abnormal operating condition, such as a power failure, a hard wired safety chain and / or spring-loaded actuators ensure that the air supply is cut off from the gasification reactor, the combustion process run out safely and over the emergency chimney the exhaust gas passes the Stirling-Motor.

**Image of the demonstration plant at Qalovis:**


## Technical Specification:

| | |
|---|---|
| **Power:** | 36 kW electric<br>up to 120 kW thermal |
| **Biomass consumption:** | depending on product quality > 52 kg / hr (36 kW el) |
| **Product:** | Natural wood as <chips, wood pellets,<br>Biomass Pellets with N <1 wt -%, Cl uS <0.01 wt -%;<br>general: water content <20 wt -%;<br>Pellet diameter and length at least 6 mm |
| **Exhaust Gas Flow:** | 1500 $m^3$ / h at 120 Grd C |
| **Space:** | at least 5 m + 1,5 m freedom |
| **Additional necessary installations:** | Fuel supply (continuous, automatic),<br>Ash container and respective conveyors,<br>Power supply, heat transfer (for example,<br>Buffer tank), the hydrogen gas supply<br>Stirling engine (from commercial gas cylinders),<br>Chimney |

Part-load capacity given by Stirling engine (lower limit at about 20 kW electrical and 75 kW thermal).

## Specific information for network integration / power supply

**Induction generator:**
The Stirling engine-generator G38 FleXgen has an
Induction generator of the Manufacturer GE Industrial Systems, Model
5KS365SAA208C. The manufacturer specifies this engine with 75 hp at 1800 rpm / min and 60 Hz by American standards. Technical Data Sheet could be provided on request.
At the production of 36 kW electric power this generator works at partial load.

**Starting current / Short circuit current:**
The above-mentioned motor is specified under European conditions with a
Short-circuit current of up to 510 A. This is briefly pulled even at start-up , but only in the time range of the first second. The short circuit current can be limited by a soft start , but this results from a certain point to other disadvantages in operation, e.g. the working gas pressure needs to be shut down in the Stirling engine.

**Voltage monitoring :**
A 3 phase-phase compact voltage monitor of the company ABB, TVM Series the Net™ is integrated in the control of the Stirling engine -generator unit FleXgen-.
This data sheet can be provided on request.
This monitor monitors the voltage drop during starting of induction generator as a motor.
At too much power voltage drop the start will be switched off by the voltage monitor.

**Cos phi :**
As explained in " Induction generator " , the generator operates in
partial load range. With 36 kW of electric power the cos phi is stated at about 0.76 .