KiRa Technology

Energy for everyone environmental sustainable

BioGS-1.0

Biomass Micro-CHP

Who we are

KiRa Technology is a innovative Start-Up operating since 2014 with expertise in energy conversion.

- Fabio Pellegrini

Mechanical engineer with experience in energy systems controls.
Mechanical design, simulation, development and testing.

- Piergiorgio Pellegrini

IT manager and programmer with experience in green building.
Development of control software.

Our solution in a nutshell

BioGS-1.0 is a micro-CHP system for domestic and small utilities use with high technological content.

- Electrical energy production
- Thermal energy production
- Very low CO2 and particulate matter emission
- Supplied by waste biomass
- Biochar production

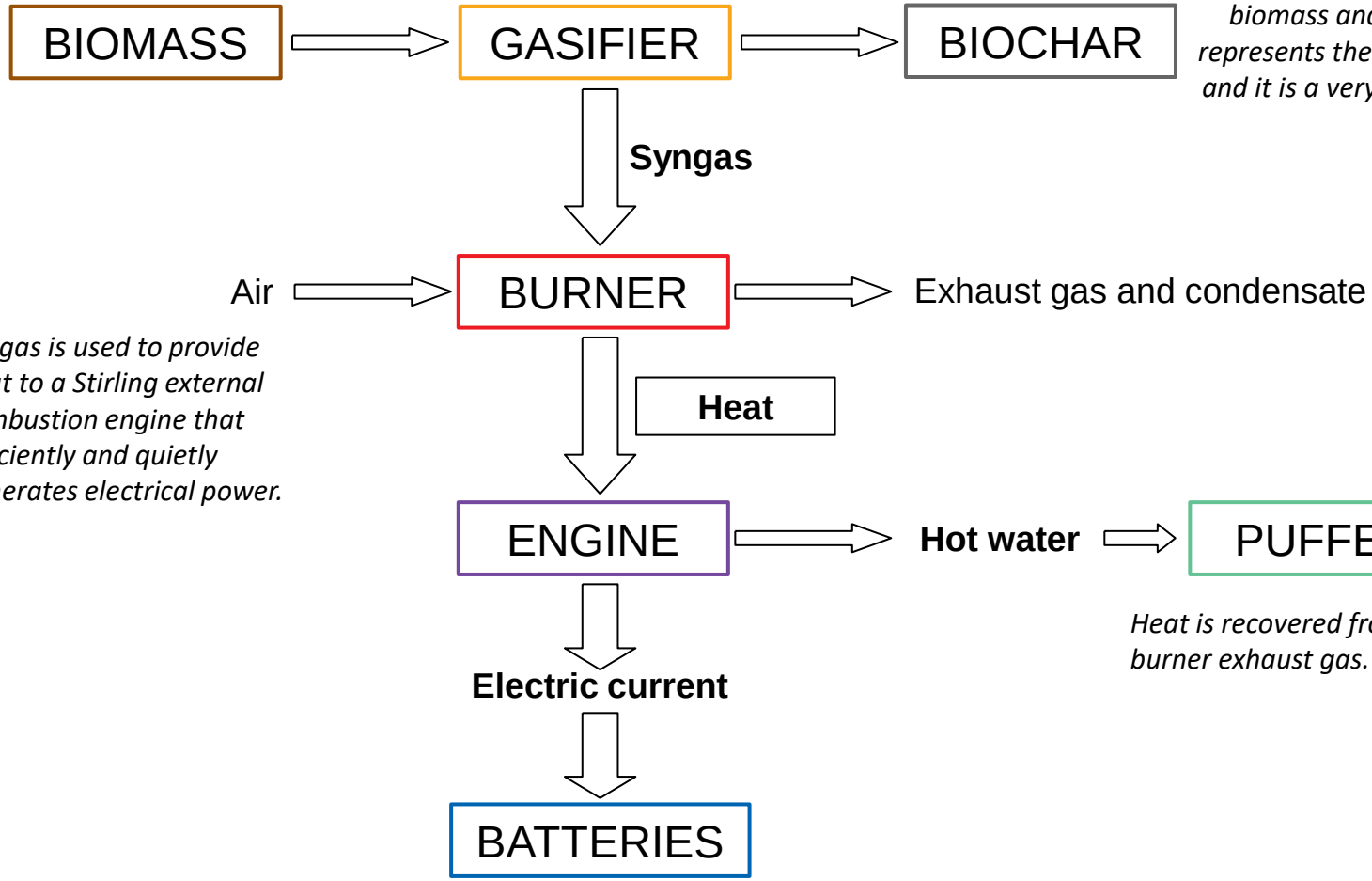
Innovative content

BioGS-1.0 is the first micro-CHP system based on **biomass gasification** and **Stirling engine** suitable for domestic and **small utilities**, main features are:

- high automation and ability to start and stop according to external energy requests
- flexibility to various types of input biomass
- accurate combustion control in order to minimize exhaust emission
- simple construction and reduced number of components in order to have a simple maintenance, according to domestic needs

How does it works

By means pyrolytic gasification process, a poor carbon fuel syngas is extracted from the biomass.



Bio-char waste product of the pyrolytic gasification contains the whole carbon non extracted from biomass and so not burned. It represents the saved CO2 emission and it is a very good soil improver.

Syngas is used to provide heat to a Stirling external combustion engine that efficiently and quietly generates electrical power.

Heat is recovered from engine and burner exhaust gas.

Pyrolytic gasification

Pyrolytic gasification is a **thermochemical process** through which a combustible gas mixture is extract from biomass.

The gas mixture (**syngas**) contain **hydrogen**, **carbon monoxide** and **methane**, has **low carbon content** and the process produce a solid waste (**biochar**) containing all the remaining carbon.

Internally developed **Downdraft Open Core** micro-gasifier

- Low CO2 emission
- Biochar production → Excellent terrain improver, can be easily and advantageously disposed on the ground.
- Input biomass from agricultural, zootechnical or industrial waste → Typically wood micro-chips or pellet, can be obtained without resort to virgin wood, because the pyrolytic reactor is insensitive to ashes or other substances normally not tolerated from pellet stove.

Burner

Burner, as well as the whole system, works by sucked air from exhaust fan.

Depression generated in the combustion chamber let syngas and combustion air to flow in it.

- Lean combustion controlled by Lambda sensor
- Condensing exhaust gas
- Stirling heat exchange optimized combustion chamber design

- Very low CO and pollutant emissions
- Extremely low particular matter emission
- Good heat input in Stirling engine
- Good heat recovery

Stirling engine

External combustion Stirling engine is particularly suitable for micro-CHP application because is absolutely insensitive to the kind of combustible to be used, and compared with traditional internal combustion engines, has lower noise emission, lower vibrations and higher efficiency in very low output power range.

External combustion let also to optimize fuel oxidation and obtain **low pollutant** end **particulate matter** emission.

1.0 kW free piston Stirling engine.

AC electrical power output suitable for both grid connection and island/hybrid installations.

- Low noise
- High efficiency
- Simple construction
- Easy maintenance

Advanced electronic control

BioGS-1.0 is provided with a custom and fully internal developed electronic control.

Gasificator

- Biomass flow
- Temperatures
- Starting heater
- Biomass tank level
- Biochar tank level

Burner

- Lambda control
- Combustion air flow
- Starting igniter
- Exhaust fan
- Temperatures
- Cooling water pump
- Condensate pump
- Thermal power

Stirling

- Start/stop
- Temperatures
- Electrical power
- Thermal power
- Grid connection

Remote control

- user can monitor and control the system
- installer can operate fast and easily in case of malfunctions

Climate impact

BioGS-1.0 has an extremely low environmental impact tanks to drastically reduced CO2 emission and a waste product of the process (bio-char) useful as ground improver.

Carbon sequestration of 100g every kilogram of processed biomass.

CO2 emission reduction of 300g per kilogram of input biomass compared to direct combustion.

Low Particulate Matter emission
PM10: <0,9 g/GJ
(Experimental data based on analysis made on TRL4 prototype)

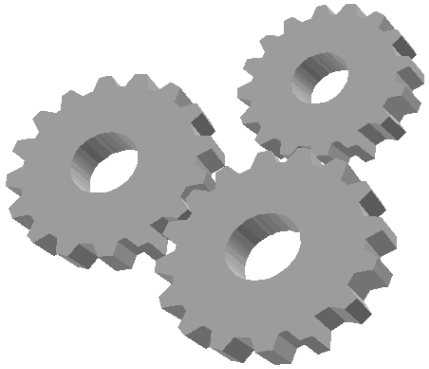
Social impact

BioGS-1.0 is completely autonomous and is able to supply energy both to off-grid and to grid connected utilities, using waste biomass and at the same time producing a useful bio-char.

For this reason represent an improvement factor of life quality.

In addition to this, we must not forget that any intervention that reduces our environmental impact improves our well-being.

Technical Aspects



- Electrical power: 1.0 kW
- Thermal power: 7.0 kW
- Global efficiency: > 95 %
- Biomass consumption: 2.0 kg/h
- Biochar production: 0.2 kg/h
- Water input temperature: 6 - 50 °C
- Water flow: 7 - 10 l/min
- Max exhaust temperature: 70°C
- Dimension: 100 x 52 x 130 cm (L x W x H)
- Electrical output voltage: 230 VAC
- Electrical output frequency: 50 Hz
- Stand-by max time: 6 month
- Surface occupation: < 4 sqm
- Possible underground installation
- Input biomass tank, externally accessible
- Output bio-char tank, externally accessible
- Need of a dried and calibrated input material (pellet or micro-woodchips)
- Electrical connection both directly to the grid or by hybrid charger/inverter with battery storage.

Integrated aspects

- Use of vegetable and zootechnics waste also produced on site
- Air cleaning by negative carbon balance
- Portable machine: no fixed infrastructures needed
- Both Off/On-grid energy suppling
- Integration with other energy sources
- Remote control
- Bio-char production

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