

# MILENA gasification process

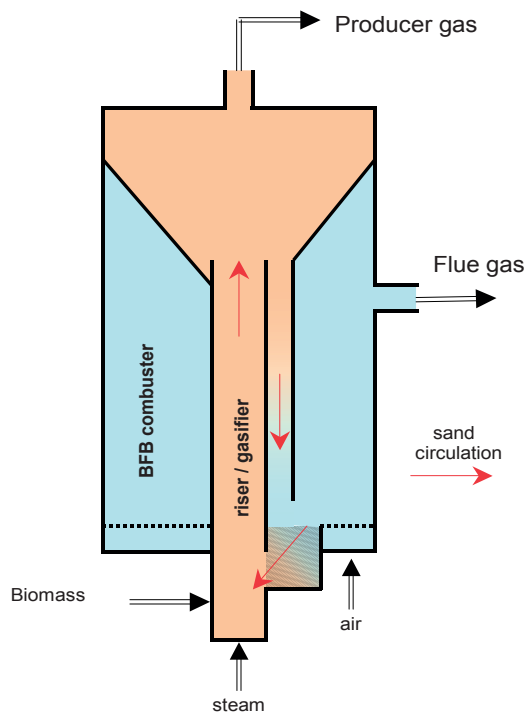
## Introduction

Biomass is seen as the most important source of renewable energy for the future. ECN develops technologies to convert solid biomass in a usable and clean form of energy with high efficiency. The MILENA gasification process is able to convert solid biomasses like (waste) wood into a gas that can be used, after gas cleaning, in gas boilers, gas engines, gas turbines or fuel cells to generate heat and electricity. The gas from the MILENA gasification process can also be converted into Substitute Natural Gas (SNG) or Green Gas and Fischer-Tropsch Diesel. SNG can be injected into the gas grid or can be used as transport fuel (Bio-CNG).

The MILENA gasification process is demonstrated at lab scale (25 kW<sub>th</sub>). The 800 kW MILENA pilot plant was taken into operation in the summer of 2008. A 10 MW demonstration is planned for the future.

## The MILENA gasification process

The MILENA process is schematically shown in the figure below.



These impurities need to be removed before the gas can be converted into heat, electricity, Fischer-Tropsch Diesel or SNG. The OLGA gas cleaning technology has been used by ECN to remove dust and tars.

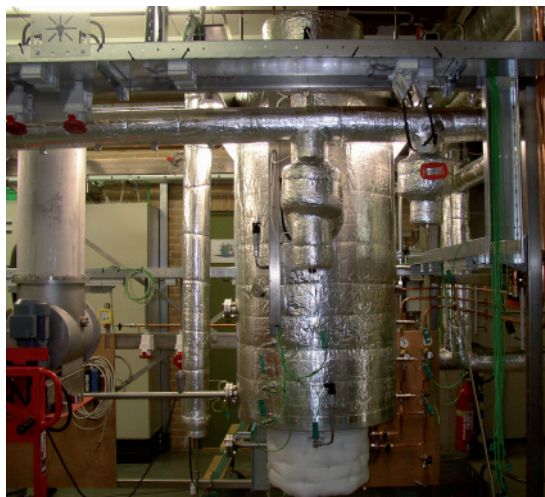
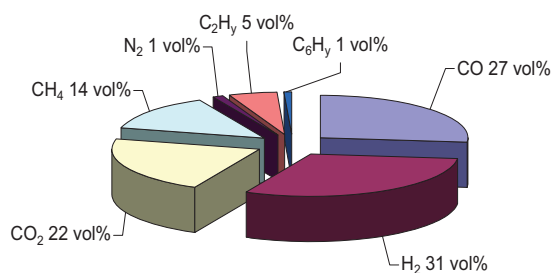


800 kW MILENA pilot gasifier

The conversion of the biomass is done in two different, but integrated reactors. This results in a medium calorific nitrogen free producer gas without the need of pure oxygen. The producer gas contains impurities like dust and tar.

### Lab-scale MILENA

ECN realized a 25 kWth lab-scale MILENA gasifier in 2004, capable of producing approximately 7 m<sub>n</sub><sup>3</sup>/h methane-rich medium calorific gas with high efficiency. The installation has been used for nearly 1000 hours. The installation consumes approximately 5 kg/h of biomass. In general wood is used as fuel, but also sewage sludge and grass were tested.



25 kW Milena lab-scale installation

The relatively low N<sub>2</sub> and high CH<sub>4</sub> concentration makes it very attractive to upgrade this gas into SNG or Green Gas.

### Further plans

The MILENA lab-scale installation will be used to do SNG production duration tests. The produced SNG will be used to fuel a car.

Duration tests of the MILENA pilot installation connected to the OLGA gas cleaning installation and tests on different fuels are foreseen for the coming years.

Preparations are underway to realize a 10 MWth demonstration plant, based on ECN MILENA and OLGA technology.

The foreseen scale for commercial CHP units based on MILENA – OLGA technology is around 10 MWth. The scale foreseen for a commercial single-train Bio-SNG production facility is between 50 and 500 MWth.

ECN owns patents on the MILENA technology; all IPR is at ECN. Interested parties are invited to discuss about licences for one or more applications.

### Further information

MILENA gasification technology

[www.milenatechnology.com](http://www.milenatechnology.com)

OLGA gas cleaning technology

[www.olgatechnology.com](http://www.olgatechnology.com)

Bio-SNG

[www.biosng.com](http://www.biosng.com)

Bio-CNG (SNG as transport fuel)

[www.biocng.com](http://www.biocng.com)

### MILENA Pilot plant

The 800 kWth MILENA pilot plant was taken in operation in the summer of 2008. The design data are given in the table below.

#### Basic design data MILENA pilot plant:

Biomass mass flow	[kg/h]	158
Steam to gasifier	[kg/h]	19
Producer gas flow wet	[m <sub>n</sub> <sup>3</sup> /h]	174
HHV gas dry basis excl. tar	[MJ/m <sub>n</sub> <sup>3</sup> ]	18.0

The gas composition from the pilot installation is similar to the lab-scale installation. A typical MILENA gas composition, on dry basis, is shown in the next figure.