Title: Case Study: 2 MW_{el} biomass gasification plant in Güssing (Austria)
Month Year: April 2004

European Commission (Directorate-General for Energy and Transport)
Contract no. NNE5/2002/52: OPET CHP/DH Cluster

Imprint

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The project "OPET CHP/DH Cluster" has obtained financial support from the European Commission (Directorate-General for Energy and Transport) under the contract no. NNE5/2002/52 for Community Activities in the Field of the specific programme for RTD and demonstration on "Energy, Environment and Sustainable Development - Part B: Energy programme"

REPORT: CASE STUDY: 2 MWEL BIOMASS GASIFICATION PLANT IN GÜSSING (AUSTRIA)

Overview

In Austria, the high efficient production of electricity and heat from organic feedstocks in small, decentralized power stations was first realised in Güssing by implementing of a new fluidized bed combustion process.

Figure 1 2 MW_{el}/8MW_{th} biomass CHP plant in Güssing (Source: RENET Austria)

The project realisation was possible due to the formation of a consortium called “Renet Austria” including the following partners:

(i) Austrian Energy as the contruction company,
(ii) EVN the regional energy utility,
(iii) Institute for chemical engineering (Technical University of Vienna),
(iv) District heating company Güssing,
(v) GE Jenbacher company, and
(vi) Repotec Umwelttechnik GmbH.

The system consists of the following main components (see also **Figure 2**):

(i) biomass feeding system,
(ii) gasifier (gasification and combustion zone),
(iii) product gas cooler,
(iv) product gas filter,
(v) product gas scrubber,
(vi) product gas blower,
(vii) gas engine,
(viii) water boiler,
(ix) flue gas cooler,

(x) flue gas filter, and

(xi) flue gas (gas engine) cooler.

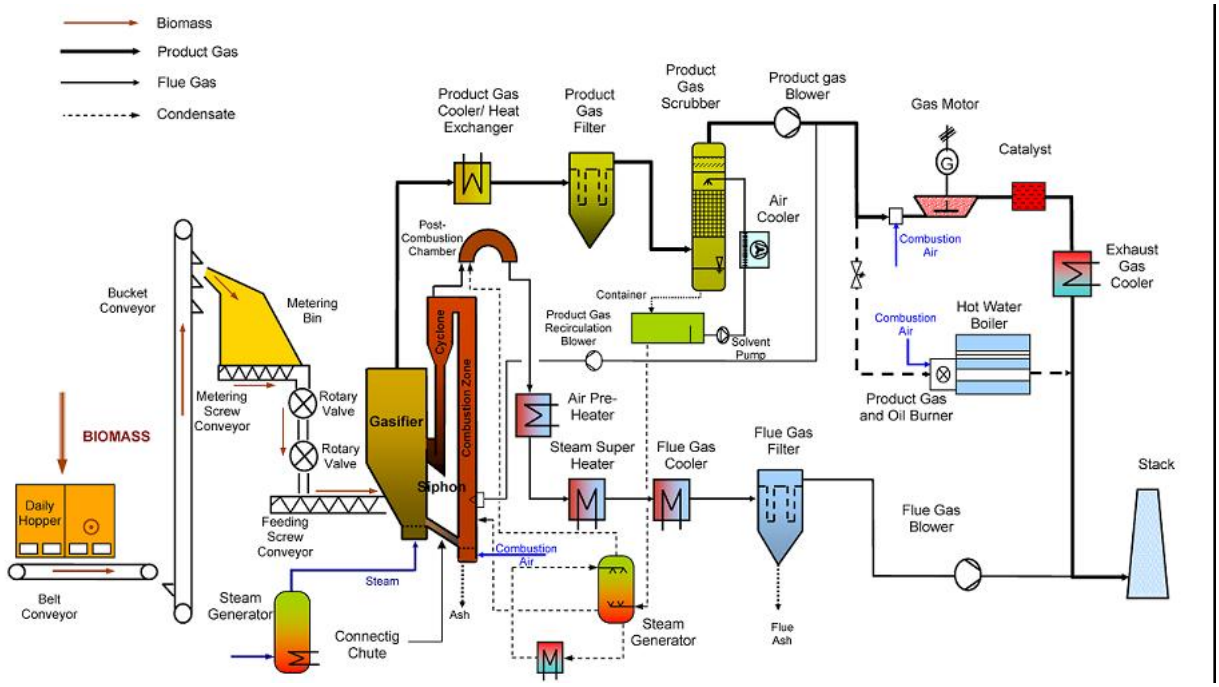

Figure 2 Schematic flow diagram of the biomass power plant in Guessing (Source: T. Pröll, April 2004)

The characteristics of the Güssing power plant are as follows (see **Table 1**):

Table 1 Characteristics of the Güssing biomass CHP power plant

Type of plant	Demonstration project
Fuel input power	8.000 kW
Electrical output	2.000 kW
Thermal output	4.500 kW
Electrical efficiency	25,0 %
Thermal efficiency	56,3 %
Electrical/thermal output	0,44
Total efficiency	81,3 %

Description of the gasification technique

The gas production reactor was developed together by the Institute of Chemical Engineering (Technical University of Vienna) and by AE Energietechnik and is internationally known under the name of FICFB-gasification system (fast internally circulating fluidized bed gasifier).

The fundamental idea of this gasification system is to physically separate the gasification reaction and the combustion reaction in order to gain a largely nitrogen-free product gas.

The endothermic gasification of the fuel takes place in a stationary fluidized bed. This is connected via a diagonal chute to the combustion section, which is operated as a circulating fluidized bed. Here, transported along with the bed material, any non gasified fuel particles are fully combusted. The heated bed material delivered there is then separated and brought back into the gasification section.

The heat required for the gasification reaction is produced by burning carbon brought along with the bed material into the combustion section. The gasification section is fluidised with steam, the combustion section with air and the gas flows are separately streamed off. Thus a nearly nitrogen-free product gas with heat values of over 12000 kJ/Nm^3 (dry) is produced. The principal of this gasification process is shown in **Figure 3**, the photo of the gasfier in **Figure 4**.

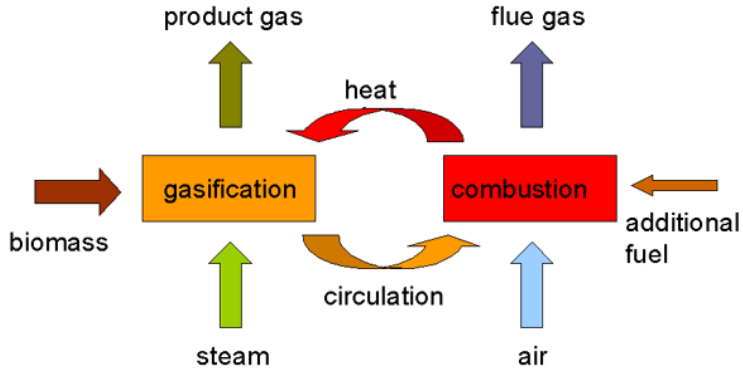

Figure 3 Principle of FICB Process (Source: Renet Austria)

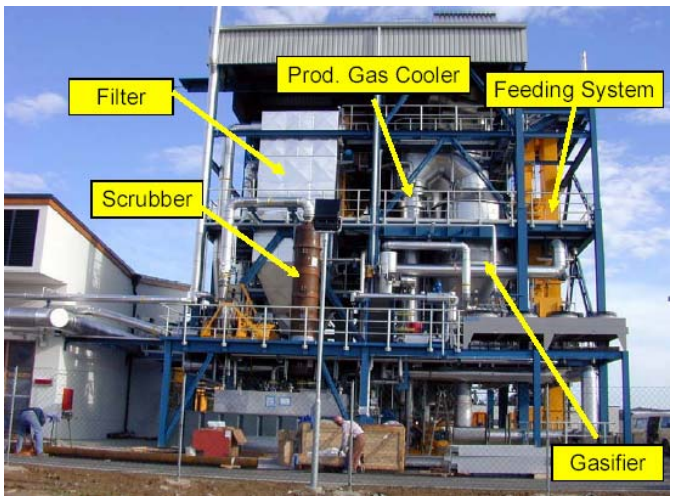

Figure 4 Picture of the gasification unit of Güssing power plant (Source: TU Vienna)

Further advantages of this method of production are its compact construction and by using steam as the gasification medium, there is a smaller tar content in the product than when using air.

Another advantage of this system is that an equilibrium between combustion and gasification reactions takes place automatically, thus one can keep the operation running stably without excessive regulation and adjustment.

As already mentioned, the gasification reaction is endothermic. If the temperature in the gasification section drops, less fuel is fully decomposed and this leads to an increasing proportion of carbon or non oxidised fuel in the combustion section.

By virtue of the increased combustion there, one transfers more energy to the bed material and this supplies in turn more energy back to the gasification section. Thus a renewed temperature rise in the gasification section is brought about.

In this way a stable equilibrium is maintained between the gasification and combustion chambers. Additionally, the temperature in the combustion section can be regulated by controlling the flow of product gas

Costs and economics

The biomass CHP plant in Güssing can be operated economically under the specific Austrian frame conditions. Despite of the quite high costs for the biomass feedstock, the operation of biomass CHP plants are currently quite well due to the high fixed feed-in tariffs for green electricity (up to 16,00 €-cents/kWh_{el} for solid biomass).

Table 2 Summary of economic data sets for the Güssing biomass CHP power plant

Cost category	**Amount**
Investment cost	10 Mio €
Funding (EU, national)	6 Mio €
Operation cost / year	10 to 15 % of investment costs
Price for heat (into grid)	2,0 €-cents/kWh_{th}
Price for heat (consumer)	3,9 €-cents/kWh_{th}
Price for electricity	16,0 €-cents/kWh_{el}

For the next plant a 25 % reduction of investment costs can be expected due to the gained experience and learning at the demonstration plant. Furthermore, the operation costs will be reduced essentially. This will be done by aiming at an unmanned operation and an reduction/optimisation of operation means (bed material, precoat material, scrubber liqued, etc.).

Further information:

RENET AUSTRIA, http://www.renet.at/
Fast internally circulating fluidized bed process, http://www.ficfb.at/

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