

**Gasification Survey Country:****Austria**

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Date: 24<sup>th</sup> April 2008

## 1. Policy

Fossil energy sources contribute most of the energy consumption in Austria, and most of them are imported. Fossil energy sources contributed about 79% of total final energy consumption in 2005. The majority of fossil energy sources were oil products (about 45%) such as heating oil, diesel, gasoline etc, Natural gas (18%) and coal (2%). Renewable energy sources contributed about 307.513 TJ (21%) of total final energy consumption in 2005.

Biomass contributed roughly 12% of the primary energy demand. From the biomass, 60% is used for heating applications, 21% for process heat, 11% for combined heat and power (CHP), and 8% for district heating. Thus, biomass is mostly used for heating applications.

Austria has a strong policy on promotion and implementation of renewable energy. Austria has obligated a reduction of CO<sub>2</sub> emissions of 13 % until 2010. Biomass has to play an important role for this reduction.

According the Directive 2001/77/EC Austria has to increase the production of renewable electricity from 70% (year 1997) to 78.1% till 2010 (the percentage is related to the 56,100GWh produced in the year 1997 and not to the actual production of electricity in the year 2010). From the actual numbers, it can be estimated, that Austria will reach this goal. Renewable electricity production is mainly supported by feed-in rates. The feed-in rates for the different types of renewable electricity are between 5 and 16 c€/kWh, depending on the type of renewable electricity and on the size of the plant (more information about renewable electricity in Austria can be found at <http://www.e-control.at>).

It is also the aim of Austria to increase the amount of renewables in the transport sector. Here the aim is to have a share of 5.75% of renewable fuels in the transport sector in the year 2008. Actually the main renewable fuel in Austria is Biodiesel. For Biodiesel no mineral oil tax has to be paid, so for the consumer the cost for Biodiesel is similar to the cost for fossil Diesel. The second measure is that for blending of renewable fuels with fossil fuels the mineral oil tax is reduced.

## 2. Programs

Over the past ten years, Austria has been catching up fast and now holds an excellent fifth position among the Member States (EU 25), with its research expenditure standing at 2.35 percent of GDP. In 2005, Austria invested about 5.8 billion Euro in research and development, 36 percent of which were raised by the public sector and almost 43 percent by Austrian enterprises. Another 20 percent were accounted for by research contracts from abroad, most of them placed by foreign multinational corporations and executed by their subsidiaries in Austria.

There are no special R&D programs for biomass gasification, but the following national R&D programs are related to bioenergy in general.

## **AUSTRIAN ENERGY RESEARCH PROGRAMMES**

Several years ago the Austrian Federal Ministry for Transport, Innovation and Technology started the mission oriented "Austrian Programme on Technologies for Sustainable Development". Within the sub programmes „Building of Tomorrow“, „Factory of Tomorrow“ and „Energy Systems of Tomorrow“ it supports target oriented research and development as well as the implementation of pilot projects. The most important call for biomass in this program is "Energy Systems of Tomorrow".

Building on these experiences and being aware of the fact that fundamental changes will be necessary in the energy sector, BMVIT started the strategy finding process „Energie 2050“ to develop a long term vision, serving as a starting point to deduct concrete concepts and strategies for future research priorities. Based on the first outcomes in 2007 the new programme for energy research „ENERGIE DER ZUKUNFT“ was launched, 2008 continued with the call „Neue Energien 2020“ in the framework of the „Austrian Climate and Energy Fund“.

### **COMET**

This program is for funding Competence Centers for Excellent Technologies, funded by the Ministry of Transport, Innovation and Technology and the Ministry of Economics and Labour. This program is the continuation of the very successful programs K<sub>NET</sub> and K<sub>IND</sub> and is also open for all technologies.

One Center for Bioenergy is established, which is the merger of Renet Austria and the Austrian Bioenergy Center. The name of the center is "Bioenergy 2020+" and the focus of R&D in this center is biomass combustion for small scale and large scale applications, biomass gasification and simulation and modelling.

### **CLUSTER „BIOENERGY AUSTRIA“**

This cluster promotes exporting for bioenergy companies.

### **3. R&D Institutes**

Graz University of Technology, A-8010 Graz  
 Department of Heat Processes  
 Institute for Apparatus Design, Particle Technology and Combustion Technology

Joanneum Research, A-8010 Graz  
 Department of Energy Research

Vienna University of Technology, A-1060 Vienna  
 Institute of Chemical Engineering

Austrian Bioenergy Centre, A-8010 Graz

Bioenergy 2020+, A-8010 Graz

FJ-BLT Wieselburg (HBLFA), A-3250 Wieselburg

## 4. Industries

Austrian Energy – AE Energietechnik,  
A-1211 Vienna; A-8010 Graz  
Energy and environmental systems, Fluidised bed gasifiers

Elin EBG, A-4020 Linz  
Gas turbines

GE Jenbacher Energiesysteme AG, A-6200 Jenbach  
Gas engines

ORTNER GmbH  
A-6010 Innsbruck, Dr. Stumpf-Str. 2  
Biomass Power Plants, Fluidised bed gasifiers

Repotec Umwelttechnik GmbH  
A-7540 Guessing, Europastrasse 1  
Biomass Power Plants, Fluidised bed gasifiers

Urbas GmbH  
A-9100 Völkermarkt, Billrothstraße 7  
Fixed bed gasifiers

XYLOGAS Energieanlagenbau und Handel GmbH  
A-8342 Gnas, Kohlberg 80  
Fixed bed gasifiers

## 5. Projects

*Graz University of Technology – Institute of Thermal Engineering*

- Evaluation and optimisation of a fixed bed gasifier, gas cleaning system and gas engine
- R&D of a two staged gasification system
- Scientific Partner in Austrian Bioenergy Centre
- Health, Safety and environmental issues for gasification systems

*Graz University of Technology - Institute for Apparatus Design, Particle Technology and Combustion Technology*

- Research on gasification and combustion in a fixed bed of solid fuel
- Fundamental research on biomass particles under gasification conditions

*Joanneum Research Graz - Department of Energy Research*

- Life Cycle Assessments
- Scientific Partner in Bioenergy 2020+

*Vienna University of Technology, Institute of Chemical Engineering*

- R&D in dual fluidised bed steam gasification
- Production of Fischer Tropsch fuels
- Production of BioSNG
- Usage of the product gas in fuel cells

- Scientific Partner in RENET Austria (Network of Competence for Energy from Biomass)
- Scientific Partner in Austrian Bioenergy Centre
- Scientific Partner in Bioenergy 2020+

#### *Austrian Bioenergy Centre*

- Pressurised gasification (in cooperation with Vienna University of Technology)
- Usage of product gas from Steam gasification in a SOFC

#### *FJ-BLT Wieselburg (HBLFA)*

- Biomass availability
- 1<sup>st</sup> and 2<sup>nd</sup> generation biofuels

## 6. Implementations

Location	Type, Capacity	Biomass feed	Owner	Status
Güssing	FICFB 2MW <sub>el</sub>	wood chips	Biomassekraftwerk Güssing GmbH & CO KG	in operation
Güssing	fixed bed 350kW <sub>el</sub>	waste wood	Pyrotherm Kraftwerk GmbH	in operation
Oberwart	FICFB 2.7 MW <sub>el</sub>	wood chips	Energie Oberwart GmbH	In commissioning

CFB ... Circulating fluidised bed

FICFB ... Fast internal circulating fluidised bed

### **BIOMASSEKRAFTWERK GÜSSING GMBH & CO KG:**

In Güssing a Biomass CHP with the concept of the FICFB gasification system was realised. The basic idea of the FICFB concept is to divide the fluidised bed into two zones, a gasification zone and a combustion zone. Between these two zones a circulation loop of bed material is created but the gases should remain separated. The circulating bed material acts as heat carrier from the combustion to the gasification zone. The fuel is fed into the gasification zone and gasified with steam. The gas produced in this zone is therefore nearly free of nitrogen. The bed material, together with some charcoal, circulates to the combustion zone. This zone is fluidised with air and the charcoal is burned. The exothermic reaction in the combustion zone provides the energy for the endothermic gasification with steam. With this concept it is possible to get a high-grade product gas without the use of pure oxygen.

The construction of the demonstration plant started in July 2000 and it started operation in November 2001. After first tests of the gasifier, the gas engine was started in April 2002. Detailed data can be found in the table below..

With this demonstration plant the scale up of the FICFB gasification process was realised and now the R&D on the gasifier and all ancillary units is going on, that the turn key contractor Repotec can bring an economical and commercially viable biomass driven power station to the market. The developmental aim is for a current-led heat power combination with high electrical efficiency for larger capacity applications.

Due to the favourable characteristics of the product gas (low nitrogen, high hydrogen content) there are several research projects, which use slip streams of the product gas. The most important are:

- production of Fischer Tropsch Diesel
- production of Methane (synthetic natural gas)

- usage the gas in a SOFC
- catalytic cracking of the tars

Owner:	Biomassekraftwerk Güssing GmbH & CO KG
Constructed by	Austrian Energy / Repotec
Power production	2000 kW
Heat production	4500 kW
Biomass type used	Wood chips
Start up	November 2001
Hours of operation (gas engine) by 30 <sup>th</sup> April 2008	32500

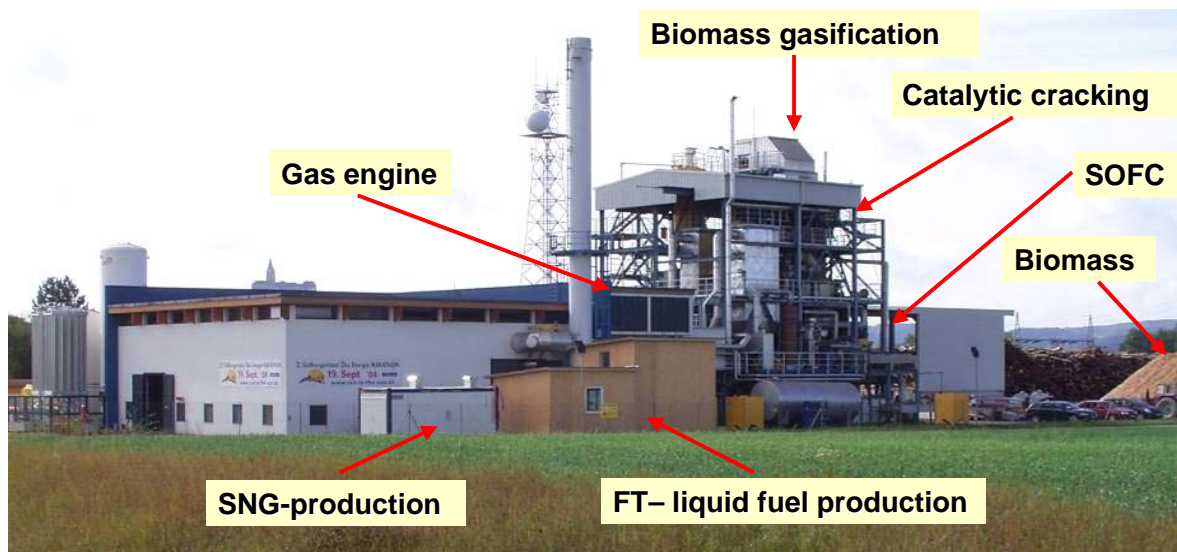


Figure 1: biomass CHP Güssing

## PYROTHERM KRAFTWERK GMBH:

This biomass CHP is based on the technology developed by Pyroforce in Switzerland. It consists of 2 parallel operated double fired fixed bed gasifiers, heat exchangers, a bag filter and a RME scrubber and the gas is used in a GE Jenbacher J312 gas engine.

The start up was in end of 2007 and the main data can be found in the table below.

Owner:	Pyrotherm Kraftwerk Güssing GmbH
Constructed by	Pyroforce / CTU
Power production	350 kW
Heat production (1) 70°C/90°C	437 kW
Heat production(2) 115°C	140 kW
Biomass type used	Clean waste wood from parquet floor industry
Start up	December 2007
Hours of operation (gas engine) by 22 <sup>nd</sup> April 2008	1250

## ENERGIE OBERWART GMBH:

In Oberwart the second Biomass CHP with the concept of the FICFB gasification system was realised. It consists similar to the biomass CHP Güssing of gas generation in a DFB system, gas cooling and gas clean-up in a bag filter followed by a tar scrubber. The cooled and cleaned producer gas is fed into two gas engines for power generation. In addition there is an biomass drying unit and an organic rankine cycle (ORC) integrated, to have a higher electric efficiency. For the ORC all heat at the biomass CHP is collected by thermo-oil and transferred in the ORC in electricity.

The construction was completed in December 2007 and since then the commissioning is ongoing.

The main data of the biomass CHP Oberwart can be found in the following table.

Owner:	Energie Oberwart GmbH
Constructed by	Ortner Anlagenbau
Power production	2750 kW
Heat production	1500-6000 kW
Biomass type used	Wood chips
Status:	In commissioning



**Figure 2: dual fluidised bed gasifier in Oberwart**