

## CASE STUDY

### My beneficial visit to ETC, Sweden



Ludwig Briesemeister of the Institute for Energy Systems at the Technical University of Munich in Germany visited the Energy Technology Centre (ETC) in Piteå, Sweden. The research that he undertook was funded by BRISK, as well as his travel and living costs.

Below is a summary of his experience at ETC.

In this project the entrained-flow gasification of biocoal, i.e. biomass made by hydrothermal carbonization (HTC), was investigated at the gasification facility at the Energy Technology Centre (ETC) in Piteå, Sweden. Biocoal from HTC was made by organic waste which so far has not been effectively used as an energy source. It was produced and provided by Suncoal Industries GmbH from a mixture of different biomass and residues as input feedstock. The aim of the research undertaken was to produce biogenic gas under different gasification atmospheres in order to produce high energetic synthesis gas for several applications, e.g. power production in a combined heat and power (CHP) gas motor.

The ETC gasifier used in the trials is the 1 MW<sub>th</sub> pressurized entrained-flow biomass gasification plant (PEBG) which is built for autothermal gasification conditions and provides several measurement applications to monitor the process. The gasifier is designed to work at temperatures up to 1500°C and pressures up to 10 bar(a). The gas produced was analysed for its volumetric composition and the calorific value respectively. Probes of unburnt fuel and slag were also taken and analysed to determine the conversion rate and the efficiency of the process.

#### ETC

ETC is a not-for-profit research organisation with a focus on thermochemical conversion of biomass.

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Figure 1: ETC research institute with Smurfit Kappa paper mill in the background.



Figure 2: Another view of ETC with the Smurfit Kappa paper mill in the distance.



Figure 3: Control room of the PEBG gasifier with ETC staff.

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It is located in the north of Sweden in Piteå which has around 20,000 inhabitants. Our stay in Piteå was for two weeks in total, allowing enough time for three days of gasification trials. The staff at ETC were very friendly and helpful when we had any concerns. During the trials we gained knowledge from the experience of the other researchers which we will be able to apply to our own project at TU Munich.

#### BRISK Application Procedure

The application process took almost one year from our first contact with BRISK until our stay in Sweden. This lengthy time was due to the complexity of the planned visit. Three different partners (TU Munich, Suncoal Industries and ETC) had to be coordinated in agreement with BRISK. In addition to this, 1.5 tonnes of biocoal was shipped from Germany to Sweden. All of this effort for two weeks of trials seemed enormous at the time. Nevertheless I think it was well worth it because of the unique opportunity of using such a special facility like that at ETC.

#### Conclusion

In this project a fairly unknown fuel was used in an entrained-flow gasifier. Gasification remained stable at different parameters of the process. By studying the data from the gas analysis and the probes that were taken from the quench, the process could be evaluated and good values for the conversion and the cold gas efficiency were reached. In summary, biocoal from hydrothermal carbonization looks promising regarding its applicability for entrained-flow gasification. At high temperatures attention should be turned on ash-melting issues.

BRISK Transnational Access enabled us to have access to special equipment and facilities. An international exchange of experience and knowledge was achieved and our future research activities will benefit from that.

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Figure 4: Molten ash (slag) collected from the water quench.



Figure 5: Pressurized Entrained-flow Biomass Gasifier (PEBG) at ETC.



Figure 6: Biocoal from hydrothermal carbonization (HTC) used during the gasification experiments.