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Thermochemical Testing Ground with Wood Gasifier CHP Plant

Initial Operating Experiences

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Overview “Thermochemical Testing Ground“

The Zittau/Görlitz University of Applied Sciences has a long tradition in the analysis of power plant systems. The ongoing development of new concepts for fulfilling growing demands in energy supply requires a scientific monitoring. This issue is tackled by the project “Zittau Power Plant Laboratory“. The storage of thermal energy can reduce today's energy demand by delivering process energy for separate processes. The usage of wood chips and thermal energy storage in small-scale combined heat and power systems (CHP) will be examined within the subproject “Thermochemical Testing Ground“.

Part of the “Zittau Power Plant Laboratory“

Project Manager:
Prof. Dr.-Ing. habil. Tobias Zschunke

Runtime of the Project:
September 2011 – August 2014

Budget of the Project:
1,8 Mio. Euro (EFRE funded)

Fuel for Gasification:
Wood Chips

Phase Change Materials (PCM):
Alkane Mixture, Sodium Acetat

Work Packages

Thermochemical Testing Ground I:
Usage of thermal energy storage for heating and cooling

Key issues:
1) Assessment of latent heat accumulators
2) Assessment of sensible heat accumulators
3) Load management of heat accumulators

Thermochemical Testing Ground II:
Gasification of wood chips in a small-scale CHP plant

Key issues:
1) Metrological monitoring of plant operation
2) Energy and mass balance
3) Modeling of gasification process

Testing Ground for Thermal Energy Storage

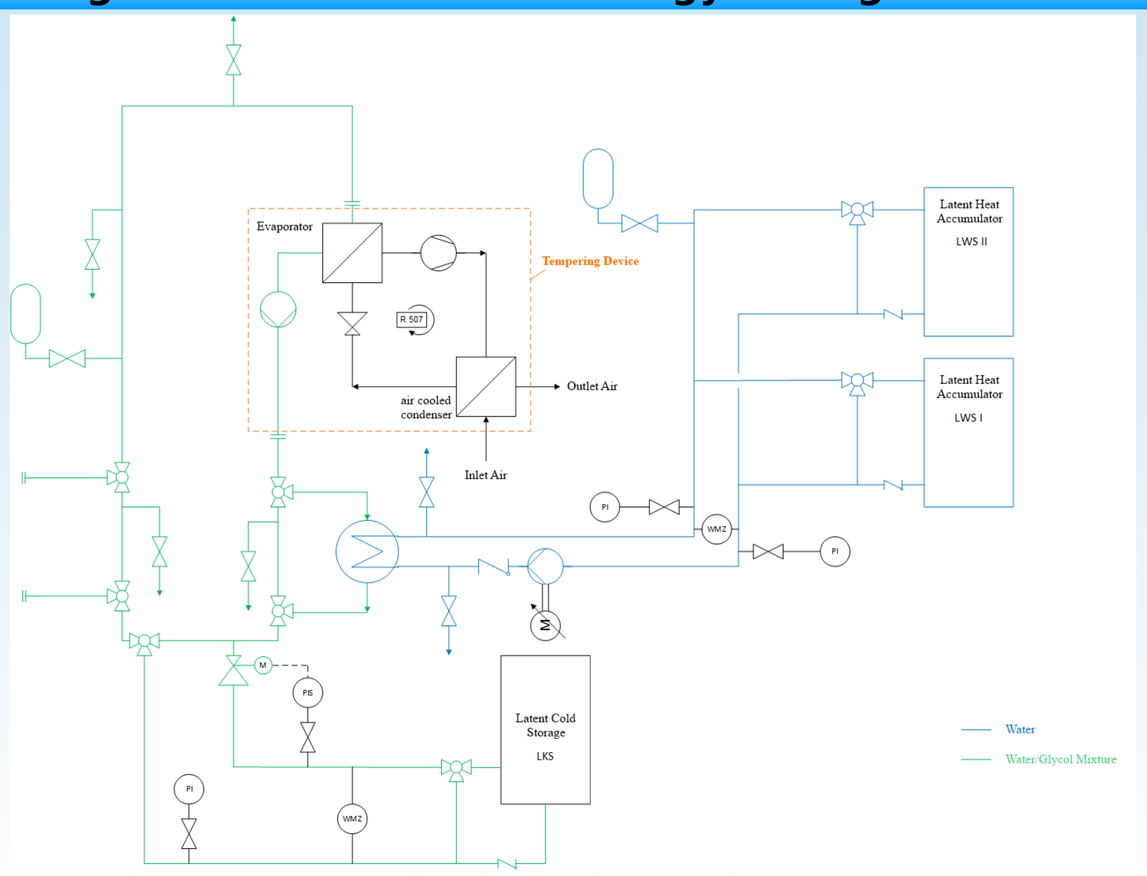

Fig. 1: Preliminary Test Design for Heat Accumulation

Testing Ground for Gasification of Wood Chips

Fig. 2: Experimental design of wood gasifier, October 2013

Stationary and Transient Gasification Processes

Due to correlated interactions, dynamic feedback and transient processes from the CHP plant unique influences are induced. The task is to evaluate all possible effects during start-up, shut down, load alternation, fuel variation on whole production process and in sub-processes (fuel treatment, wood chip drying, gasification, gas cooling and gas dehydration, engine operation).

Aspects of Thermal Energy Storage

Thermal energy storage can be realised by sensible heat accumulators, latent heat accumulators or thermochemical accumulators. Within the scope of the projects the different energy and mass balances each storage principle induces shall be determined. The occuring flows differ between each storage device in transient processes like loading of the accumulator and during a phase change of latent heat storage materials. It is striven to establish a cooperation with institutes, e.g. Fraunhofer IFAM Dresden, already working on this topic.

Measuring Campaigns

The measuring campaigns are focused on charging/discharging behaviour of latent heat accumulators.

For the selection of measuring devices space requirement and various ranges of loading temperature had been taken into account. The effects of ambient conditions on thermal energy storage can be determined by an associated fault analysis.

Latent Heat Accumulator

Commercial Latent Heat Accumulator

Type of PCM:
Alkane Mixture

Melting Range:
(56 ... 71) °C

Capacity:
311 kWh

Computational Modeling

The simulation and modeling of thermal energy storage focuses on

a) Reproduction of complex processes and sub-processes and phase change materials in theory
b) Transient models of various latent and sensible heat accumulators

Future Plans

The project aims for better knowledge concerning thermal energy storage and gasification.

Thus there is the future plan to a certification procedure for various thermal heat accumulators. The research will also help to broaden the teaching level of the university.

Preliminary Result: Wood Gas Composition

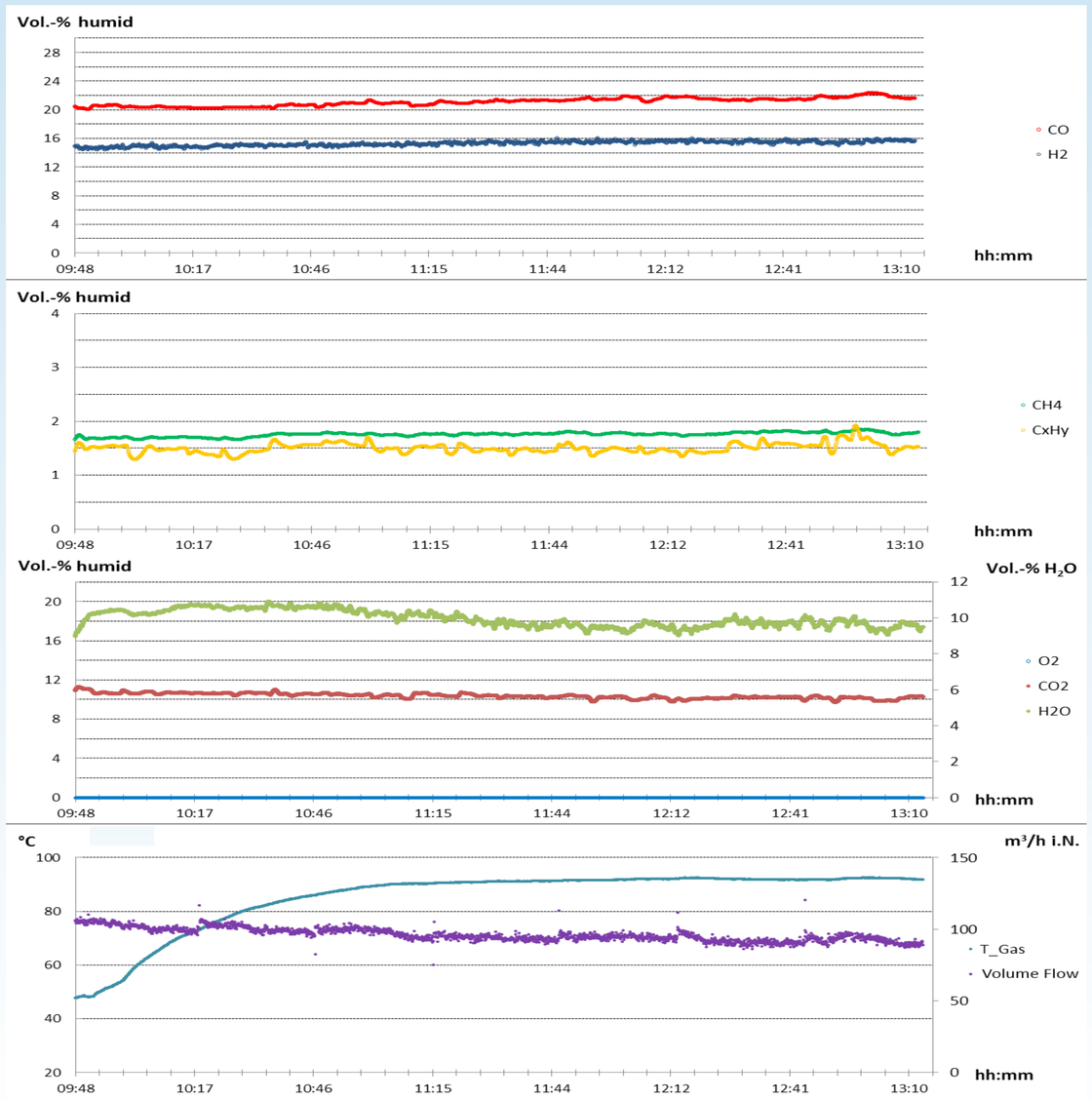

Fig. 3: Composition of wood gas, measurement at CHP engine inlet

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