Success Story

COMET

FFG

bioenergy2020+

BE2020

BIOENERGY2020+ GmbH

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: K1-Centres

COMET subproject, duration and type of project:

The virtual biomass fired boiler, multi-firm (01.04.2012 – 31.03.2015)

+ IK project BioCorrSim, multi-firm (01.04.2011 – 31.12.2014)

The virtual biomass fired boiler

In several years of research work, BIOENERGY 2020+ has developed a CFD-based deposition and fine particulate formation model for biomass-fired boilers. The application of this model makes an important contribution to a better understanding and, therefore, a reduction of the problems associated with fine particulates in the development of new boiler technologies. Moreover, the simulations contribute to a development of plants with reduced ash deposits and corrosion of the heat exchanger tube bundles, and, therefore, with enhanced plant efficiencies and availabilities.

The model

Avoiding the formation of solid ash deposits and high temperature corrosion in biomass fired boilers is of great importance in terms of achieving high boilers efficiencies and availabilities. Reducing fine particulate emissions is also becoming increasingly important, on the one hand due to increasingly stricter emission limits and on the other hand due to the increasing demand for new ash-rich fuels such as short-rotation coppice, Miscanthus and agricultural residues.

In several years of research work, BIOENERGY 2020+ has therefore developed a CFD model for the simulation of the most relevant ash related problems in biomass fired boilers (including the heat exchanger tube bundles):

bmwfw Federal Ministry of Science, Research and Economy

bmvit Austrian Ministry for Transport, Innovation and Technology

- Fine particle formation
- Ash deposit formation and reduction of thermal efficiency
- Corrosion of heat exchanger tube bundles and reduction of plant availability
    - Empirical corrosion model which estimates the local corrosion potential based on a CFD simulation of flow and heat transfer
    - Detailed corrosion model considering the underlying processes (e.g. Chlorine corrosion and oxidation).

With this model, a leading international position was achieved in the CFD simulation of boiler plants: The model is characterised by its high degree of flexibility in terms of the fuels used, with a highly detailed description of the ash chemistry and the underlying processes.

Selected results

Fine particle formation simulation

The results are illustrated by the following figure, which shows the left the fine particulate concentrations (mg/Nm3 tr, 13% vol. O2) in a 70 kilowatt pellet boiler.

For the purpose of checking the model, the simulation results were compared with measurements. It was found that the predicted fine particulate emissions are in good agreement with the measurements (simulation: 9.92 mg/Nm3; measurement: 7.65 mg/Nm3).

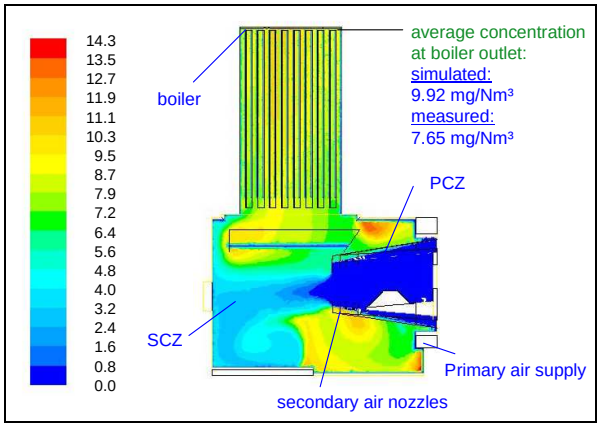

Fig. 1: CFD simulation of fine particle formation in a 70 kW pellet boiler

Simulation of the corrosion potential

The modelling results are illustrated by the following figure, which shows the calculated corrosion potential of the first two superheater bundles [mm/1000h] of a 42 MW biomass fired steam boiler.

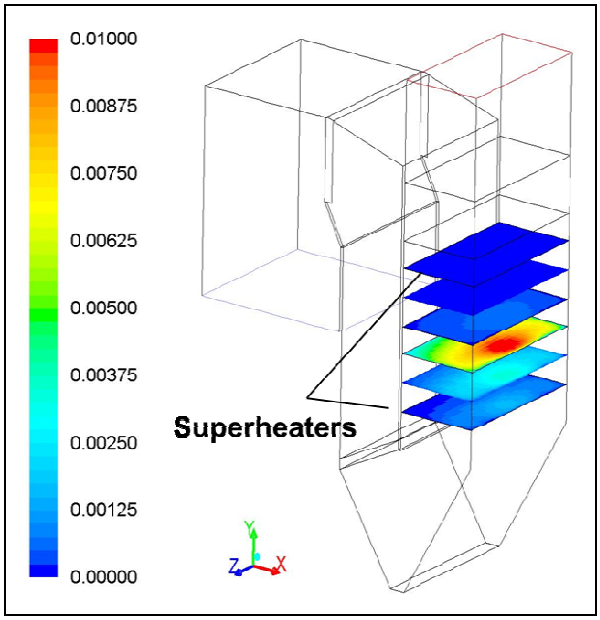

Fig. 2: [Please describe the figure/picture (copyright)]

Impact and effects

The use of the model under development as a process analysis tool makes an important contribution to a better understanding and, therefore, a reduction of the problems associated with fine particulates in the development

of new boiler technologies. Moreover, the simulations may lead to a development of plants with enhanced plant efficiencies (reduced deposit layers) and availabilities (blocking by ash deposits and corrosion damages).

Contact and information

K1-Zentrum BE2020

BIOENERGY2020+ GmbH
Inffeldgasse 21 b, 8010 Graz
T ++43 316 873 9201
E office@bioenergy2020.eu, www.bioenergy2020.eu

Project coordinator

Dr. Robert Scharler

Project partners

Organisation	Country
Technical University Graz	Austria
University of Augsburg	Germany
KWB Kraft und Wärme aus Biomasse GmbH	Austria
GKS - Gemeinschaftskraftwerk Schweinfurt GmbH	Germany
Viessmann Werke GmbH & Co. KG (früher: MAWERA Holzfeuerungsanlagen GmbH)	Germany
BIOS BIOENERGIESYSTEME GmbH	Austria
Josef Bertsch Gesellschaft m.b.H. & Co. KG	Austria
Polytechnik Luft- und Feuerungstechnik GmbH	Austria

Further information on COMET – Competence Centers for Excellent Technologies: www.ffg.at/comet
This success story was provided by the consortium leader/centre management for the purpose of being published on