

Success Story

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Innovative model based control strategy for biomass steam boilers

Conventional control strategies currently applied in biomass furnaces are principally not capable to operate the plants in an optimal manner. For this reason a new model based control strategy for biomass furnaces with steam boilers has been developed and implemented at an industrial plant. The new control reacts quicker to changes in the operating conditions and compensates external disturbances before they affect the plant's operating status negatively. This leads to an increase of the system's stability and operation reliability as well as higher efficiencies.



Conventional control strategies

Conventional control strategies currently applied to biomass furnaces consist of simple

sub controllers. They work almost independently and just partially or even not at all consider the coupled and non-linear behaviour of furnace and boiler. External disturbances,

e.g. a change in the desired heat flow, are typically not considered until a deviation of one of the control variables is measured, leading to a relatively poor operational stability and bad control performance. For this reason, highly dynamic processes pose a big challenge for biomass furnaces with conventional controls. In particular, biomass furnaces with steam boilers for the production of process steam need to react quickly to changes in the demanded heat flow while maintaining high operational reliability.

The following illustration shows the steam pressure and the consumed steam mass flow for plant operation with a conventional control and the newly developed model based control.

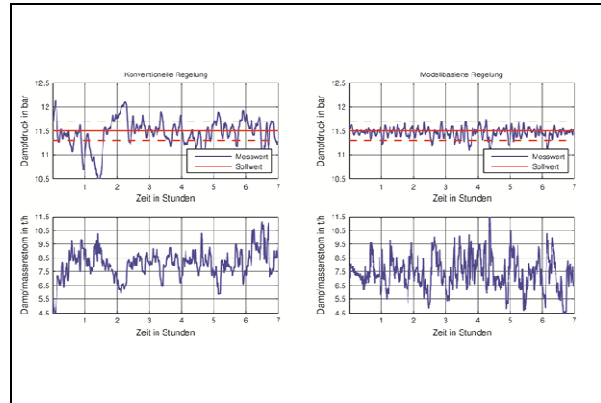


Fig. 1: Steam pressure and the consumed steam mass flow for plant operation with a conventional control and the model based control

Model based control strategy

To fully exploit the potential of modern biomass furnaces, the application of advanced control strategies considering the couplings and non-linear relationships between the physical variables is required. This is why BIOENERGY 2020+ has developed a modern, model based control strategy for biomass furnaces with steam boilers and implemented it at an industrial plant for the production of process steam in cooperation with the biomass boiler manufacturer POLYTECHNIK.

The new control strategy is based on mathematical models describing the physical behaviour of the biomass furnace and the steam boiler. External disturbances can be compensated quickly and target-oriented consequently increasing the biomass furnace's dynamic behaviour as well as the fuel flexibility. This results in a higher operational stability and a better controller performance leading to a more reliable steam supply. Thus, the use of fossil peak load boilers normally compensating quick load changes can be minimized.

Impact and effects

It can be seen that the model based control strategy achieves a higher control quality for the steam pressure. Despite stronger variations in the consumed steam mass flow the deviations of the steam pressure are reduced, indicating a more stable plant operation. Thus, the worldwide first successful implementation of a model based control strategy for biomass furnaces with steam boilers could be achieved.

The model based control strategy for biomass furnaces with steam boilers developed and implemented demonstrates the potential of advanced control strategies in energetic biomass utilization. The model based control enables higher efficiencies and lower emissions as well as increased fuel flexibility. A more stable load control, even during demanding load variations, minimizes the use of fossil peak load boilers. Furthermore, the improved dynamic behaviour enables new possibilities

for the application of biomass furnaces in highly demanding processes.

Contact and information

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