LAMTEC innovation

Modular CO λ Control for Biomass Combustion Plants

- Saves fuel and operating costs
- Reduces CO_e, dust and No_x emissions
- Easy retrofitting to existing biomass combustion plants

LAMTEC

Sensors and systems for combustion technology

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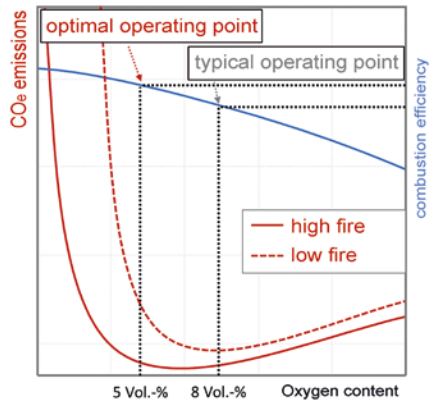
Advantages of CO λ control



Principle of CO λ control

The lower the oxygen content of the flue gas is set, the greater the effectiveness of the biomass combustion plant.

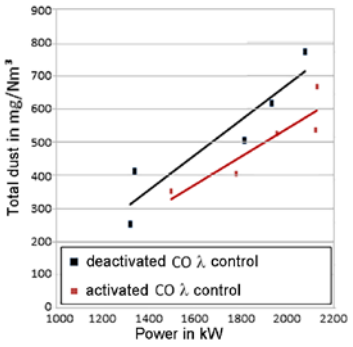
If oxygen contents are too low, however, the result is incomplete combustion and extremely high CO_e emissions.

CO λ control sets an optimum oxygen content which simultaneously maximises effectiveness and minimises CO_e emissions for any firing rate condition.

Emissions reduction through CO λ control

- Minimises fuel consumption, thus also reducing nitrogen oxide emissions (NO_x).
- Minimises CO_e emissions, at the same time reducing emissions of other pollutants (e.g. dust, PAH).

In this way, CO λ control avoids typical problems associated with incomplete combustion (e.g. soiling of the heat exchanger).



Example: typical biomass heating plant
Nominal output: 5 MW_{th}
Annual heat sales: 12,000,000 kWh

Annual fuel consumption: 16,000 m²
6,400 m² sawmill by-products (40 %)
9,600 m² forest wood chips (60 %)
Costs for forest wood chips: € 20 per m²

- Up to 4 % fuel saving (forest wood chips)
- **Cost saving: up to €7,680 per year**

In addition:
30 % reduction of the flue gas mass flow and
45 % reduction of the secondary air mass flow

Cost savings

Preventing the problems associated with incomplete combustion reduces operating costs.

The increase in effectiveness resulting from the use of CO λ control - typically 2-4 % - significantly cuts fuel costs.

Electricity costs are also reduced due to lower fan speeds (e.g. secondary air and flue gas fan).

As a result, investment in a CO λ control pays off after only a short time.

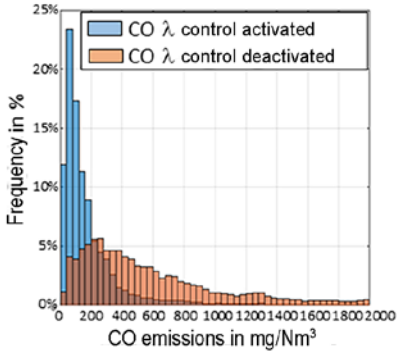
Long-term verification of CO λ control

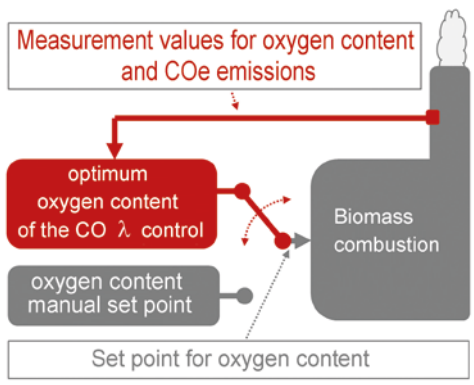
The CO λ control was tested in a heating plant over an entire heating season.

Heating plant: Biomass combustion plant for wood chips for a local heating supply with a nominal output of 2.5 MW_{th}.

- Tested over 5 months (November 2018 to March 2019)
- **1155 h operating hours** with CO λ optimisation

- Reduction of fuel consumption by **-3.8 %**
- Reduction of NO_x emissions by **-3.8 %**
- CO emissions decreased by **-200 mg/Nm²** (see diagram, right)
- Total dust emissions decreased by **-19.5 %** (see diagram, top right)





Functional principle of CO λ control

- Continuously determines the optimum oxygen content for the current operating point of the biomass combustion plant
- Specifies this optimum oxygen content as the set point for the existing oxygen control of the biomass combustion plant.

In this way, the optimum oxygen content replaces the manual set point value from the user interface or other automatically defined set point for the oxygen content.

Existing safety and control measures are thus maintained.

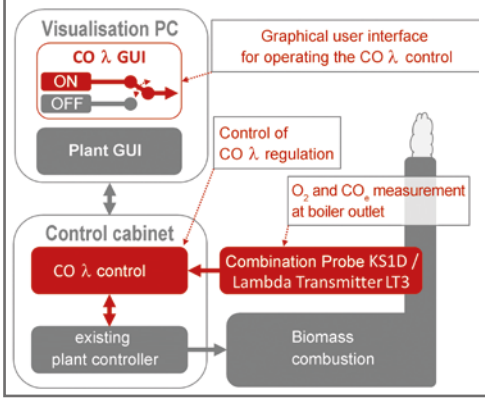
Use of robust in-situ flue gas sensors

The CO λ control uses the robust Combination Probe KS1D together with the Lambda Transmitter LT3 (see image on the right).

This tried and tested sensor system, which has proved its worth in thousands of applications, supplies a measured value for CO_e emissions as well as a measured value for the oxygen content.

The Combination Probe KS1D can be used to replace other commercially available oxygen probes, as it is identical in design as regards installation.

The Lambda Transmitter LT3 supplies the signals with the oxygen content and CO_e emissions to the CO λ control.



Integration into the biomass combustion plant in 3 steps

- The CO λ control is installed, for example in the control cabinet, and connected via cable to the existing plant controller.
- The control signals from the CO λ control are integrated into the software of the existing system control.
- A Combination Probe KS1D is installed in the flue gas pipe at the boiler outlet, the probe cable is plugged into the Lambda Transmitter LT3 and the transmitter connected to the CO λ control via cable.

This means that all biomass combustion plants with existing O_2 control can be quickly and easily retrofitted with CO λ control.

Image: Heating plant in Fuschl am See

Reference installation: Fuschl am See

Operated by: s.nahwaerme.at Energiecontracting GmbH

Biomass combustion plant for wood chips for local heating supply
Nominal output: 2.5 MW_{th}

Components of the CO λ Control

LAMTEC Combination Probe KS1D

The LAMTEC Combination Probe KS1D is available in various versions. In combination with the Lambda Transmitter LT3, it forms an innovative measuring device for combustion plants of all types:

Combination Probe KS1D

Characteristics:

- Measurement directly in the moist flue gas up to 300 °C.
- Flue gas with low dust load.
- Protection type IP42; if installed outdoors, the probe must be protected against water, snow, etc.

Areas of application:

- Natural gas, heating oil El, biomass.

Lambda Transmitter LT3

The LAMTEC Lambda Transmitter LT3 is supplied with a User Interface (UI). The LT3 is equipped with the following connections:

- Mains connection
- Connection for KS1D probe
- 2 x 4 – 20 mA signal for the measured O_2 and CO_e value
- LAMTEC SYSTEM BUS (LSB) for connection to the modular CO λ control

Combination Probe KS1D for manual cleaning

Characteristics:

- Measurement directly in the moist flue gas up to 450 °C.
- Adjustment during operation possible using test gas.
- Protection type IP65.
- Flue gas with moderate to high dust load.
- Manual compressed-air cleaning.

Areas of application:

- Natural gas, heating oil El, heating oil S, coal, special fuels, biomass.

LAMTEC CO λ control module

The CO λ control module calculates the optimum oxygen content based on the KS1D probe data from the LT3 and specifies this value as the set point for the PLC of the biomass combustion plant. Among others, the module is equipped with the following connections:

- 24 VDC voltage supply
- Field bus (for connection to the LT3 and the system PLC)
- 2 x 4 – 20 mA signals
- Modbus TCP
- PROFIBUS DP
- OPC-UA

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