

## Pro-active, calorific value driven boiler control. Higher degree of plant automation- Determination of calorific value, water and ash content in biomass fuel

The primary energy fed into your boiler varies with the material quality. The calorific value changes heavily, due to varying water and ash content. This typically leads to a fluctuating boiler load or thermo oil temperature and to a fluctuating electricity production. Further, the fluctuating material qualities often lead to fluctuating emissions (especially CO) and possibly breaches of permit limits.

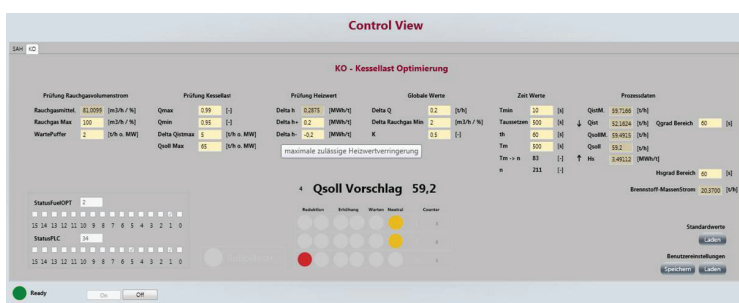
### APOS' target is to have a more constant steam production!

This is where BoilerControl comes into play: The system determines water content, ash content and calorific value at the measurement location using a purely optical technology and the analytics solution. The APOS application software is connected to the process control system (PCS) of the customer boiler via a standard interface. Via this interface, all necessary parameters such as steam flow/ thermo oil temperature, material feed speed under grate wind and some other values are called off the PCS bus to analyze the current boiler state. After analyzing the current boiler parameters and running a comparison to the target parameters, the APOS application software returns e.g. an adjusted parameter such as water content or calorific value equivalent to the PCS. The PCS is now able to adjust the boiler settings using the additional APOS parameters, still using its standard control schemes.

Since all power plants are different and the task to be resolved by the PCs and the APOS system is often very different, APOS uses different control modules of the product BoilerControl. Available modules are:



Screenshot Software BoilerControl



Screenshot Control View

#### Disturbance control

Automatic transmission of a low pass filtered calorific value equivalent value to the PCS and resulting improved under grate wind and material feed, depending on calorific value of the material. More balanced operations and more steady steam and electricity production. Efficiency improvements typically vary between approximately 0.5% and 1.5%.

#### Boiler load optimization:

Dynamic adjustment of the target steam production. This tool dynamically adjusts the boiler load settings, depending on material quality/calorific value and other boiler parameters (e.g. maximum flue gas flow rates). The boiler runs automatically at the maximum performance possible with the current material quality. Especially useful in times of using low calorific materials, such as rainy periods, winter, etc..

#### CO Control:

CO control application by managing the material feed in accordance with the calorific value measured: if the calorific value of the material is unknown CO emissions might exceed permitting limits regularly. CO Control monitors CO emissions, measures the calorific value of the material and supplies parameters to the PCS to adjust material feed and wind volumes on the residual oxygen content in the flue gas is also possible.

Please note that the existing boiler PCS remains the system-in-command at all times and the APOS system „only“ provides additional, more intelligent values to the PCS. The customer can control the system by pressing a on-off button in the PCS any time. The APOS system is a purely optical, high availability system. Even if the APOS system should go off-line the power plant will continue to operate in the old, less optimal mode. Thus operation is guaranteed any times. On request, APOS can extend the system for other materials by additional custom calibrations. Additional controls applications are on the development road map. Customer requirements may get priority upon request. Ask us.

## Specification Measurement System

Wavelength used	950nm – 1690nm
Measurement interval	> 60 values/minute
Number of probes	1 – 2
Repeat accuracy	< 0.5%-standard deviation points

## Central Spectrometer Unit (CSU)

Form Factor	400mm x 500mm x 250mm (WxHxD)
Weight	25kg // 55.1lb
Electrical protection class	IP 54
Ambient temperature	Unheated, cooled +5°C to 50°C // 41°F to 122 °F Heated, cooled -20°C to 50°C // -4°F to 122 °F
Relative air humidity	Max. 80%, non condensing
Interfaces	Ethernet
Power Supply	230V AC // 120V AC

## Contact Probe Head

Form Factor	Diameter 165mm // 6.5in, Length 178mm // 7in
Weight	4.5kg // 9.9lb
Measurement window	sapphire glass, 17,25mm // 0.67in diameter
Electrical protection class	IP 65
Ambient temperature	-20 °C to 60°C // -4°F to 140°F
Flange Type	DN50 PN10-16s
Data transfer	RS 485 and fiber optic cable
Light sources	2 x max. 5 W
Bulb life time	Approx. 5,000h per bulb, two bulbs installed; exchange bulbs is necessary after one year of operation or if the system issues a warning.
Power Supply	24V DC; 400mA

## Hybrid connector cable

Consisting of	Communication (RS 485), power supply, fiber optic cable
Diameter	10 mm // 0.39in
Weight	120g/m // 0.08lb/ft
Maximum bend radius	70mm // 0.23ft
Optimal bend radius	150mm // 0.49ft
Ambient temperature	-40°C to 80°C // -40°F to 176°F

## Calibration Models

Water Content/Humidity	continously updated by APOS
Ash Content	continously updated by APOS
Further Parameters	Upon request

## Distance Probe

For specific applications, the APOS distance probe can be used. The distance probe is a non contact probe and can be up to 350mm/1.1ft away from the to be analyzed material flow