

The effect of additives on boiler corrosion

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Presentation outline

- 20th anniversary of On-line Corrosion Monitoring
- Effect of additives on boiler corrosion
- The BECC in the Netherlands
- Campaign 2017 with first findings
- Follow-up campaign planned in 2019

Probe overview

- Radiant Probes



- Superheater Probe

Status of corrosion monitor in 2019

A sensible/practical application of an electrochemical corrosion monitoring system all comes down to a proper implementation:

- Different probe designs for specific applications (radiant and superheater)
- Highly reliable and fast temperature control (air controlled)
- Downsized equipment
- Local data pre-processing and remote access
- Latest IT (cloud) solutions
- Advanced data-analytics (SAS VA/Enterprise dataminer)
- Corrosion/fouling dashboard in the control room

The Ultimate Aim: **Optimisation of plant Efficiency/Availability by reducing Fouling/Corrosion**

The BECC Biomass CHP in the Netherlands



REFAWOOD

ERA-NET
Bioenergy

Plant history

- The Cuijk power plant from Essent started production in Oct 1999 and was mothballed in May 2010.
- The BECC acquired the Cuijk power plant from Essent in June 2015
- The power production of the BECC started in Oct 2015
- Multi fuel combustion was initiated in Dec 2015
- Emission test within limits was completed in Feb 2016

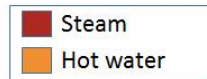
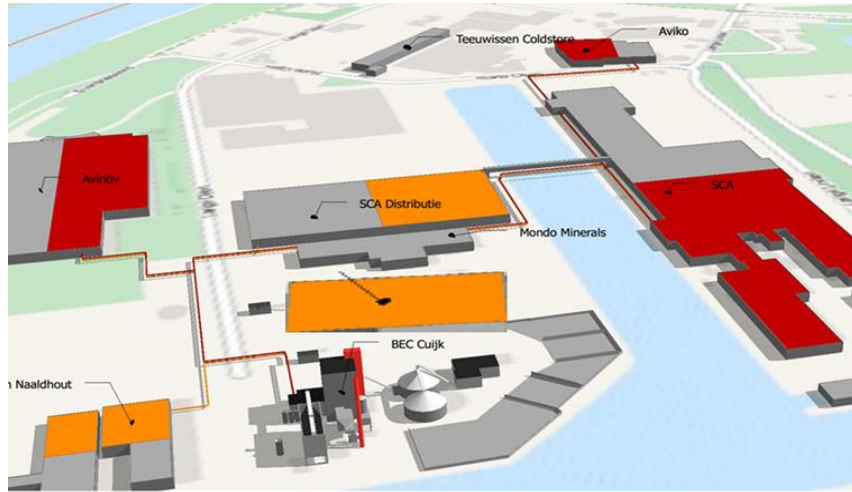


“Biomass power plant doubles efficiency”



- BECC started to development the heat grid in Mar 2016
- Construction of the heat grid started in July 2017
- Plant modifications/upgrades towards a modern combined heat and power unit started also in 2017
- First delivery heat and power started in jan 2018





Heat grid steam
and hot water

Smart Energy System Cuijk

SES Cuijk =

I Biomass CHP

II Plus direct powerline

III Plus energy storage and optimisation

IV Plus other renewable production

Smart services for business end users

BECC FACTS

- Initial investment BEC 50 € million
- Heat grid 6 € million
- Smart Energy System 10 € million (expected 2018-2020)
- Volume biomass 250.000 ton per annum, 130 m³/hour
- Boiler fluedized bed
- Generator 28 MWe
- Nett efficiency E ca. 30%
- Steam turbine 100 bar; 520° C, 100 ton/hour
- Cooling system Air cooled condenser 0.1 bar; 45° C
- Electrostatic Fluegasfilter Dust: 15.000 - 25.000 to 5 - 10 mg/Nm³
- DeNOx NOx: 250 - 300 to 50 - 90 mg/Nm³
- Chimney 50 meter high
- Renewable electricity 200 GWh per annum
- Renewable heat 80 MW
- Nett efficiency heat 2 customers ca.55%, 3 customers ca.80%



Typical BECC fuels

- Shreds
- Sawmill dust
- Pruning wood chips
- Forest residue
- Shredded tree trunks

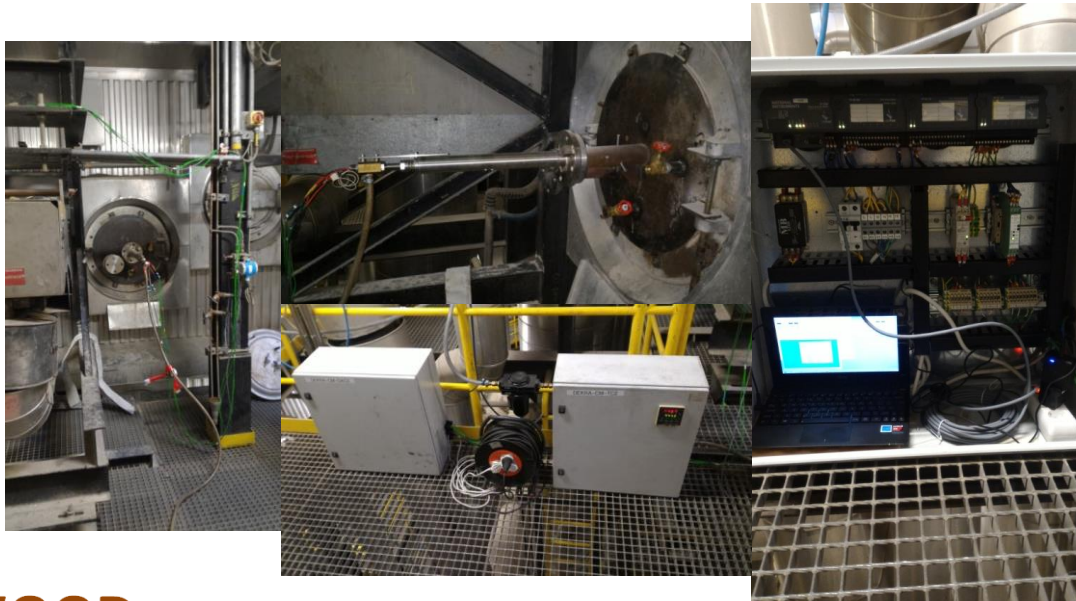
- Biogranulate
- Clean Waste wood
- Papersludge



Preparing trials at Cuijk

- Preparations started in June/July 2016 by visiting BEC
- BECC prepared access port for superheater boiler section and economiser section; two ported acces for corrosion monitor and endoscope
- Two probes were constructed and 1 set of spare parts for a complete probe rebuild.
- Refurbishment of equipment, software update

Corrosion and Fouling measurements in BECC (Cuijk) November 2016



First trial weeks at Cuijk

- The corrosion/fouling monitoring system was successfully installed beginning of November 2016 at the BECC
- Problems occurred prior to biweekly blasting --> The deposit built up on the probe made it impossible to retract it without force
- Probe survived the heavy beating with a hammer, but the access port needed to be modified (larger diameter).
- Half November 2016 an endoscope was tested and is standby on site



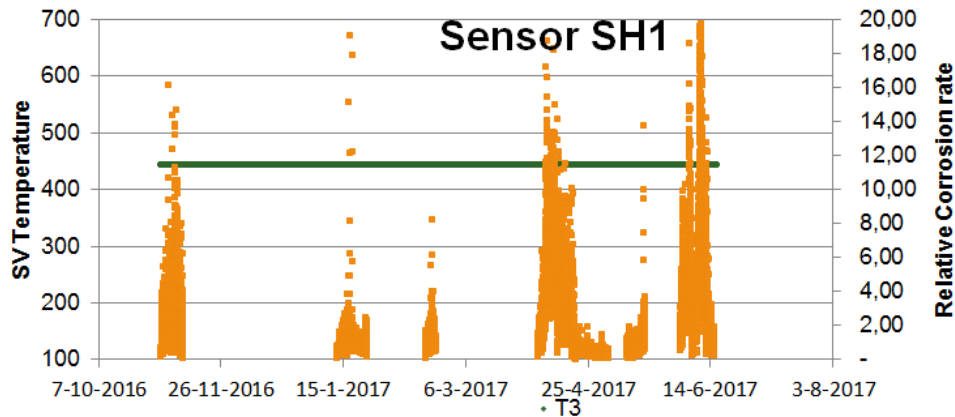
Refawood planned trails june 2017

2017			WEEK			
	23	24	25	26	27	
wastewood (truck/week))	30	30	30	30	30	
wastewood (ton/week))	510	510	510	510	510	
papersludge (truck/day))	1	2	3	0	2	
papersludge (ton/day)	30	60	90	0	60	
total/week	660	810	960	510	810	
%papersludge/week	5	7	9	0	7	
Sample	x	x	x	x	x	
Cleaning probe	x	x	x	x	x	

Actual execution of the trials

- Unfortunately plant operation during the trials was too unstable to generate reliable measurements for the campaign (partload, dosing problems/limitations and temporarily boiler of line due to sand bed pollution. Therefore the measurements are less representative to determine the influence of fuel/additive mixtures on corrosion and fouling.

First findings



Follow-up campaign planned in 2019

- The follow-up campaign was initially planned after the plant modification in early 2018
- However, problems occurred during the start up after the plant modifications (not related to the modification)
- The permitting procedure for the campaign took longer than anticipated
- Planned fuel/additives: Clean wood, Waste wood, Papersuldge, Gypsum and Sewer Sludge
- Planned campaign: Q2/Q3 2019

Improvements over first campaign

- More stable plant operation due to plant modification (e.g. optimised economiser layout)
- Modern DCS system and additional emission measurements
- Lessons learned from first campaign

Thank you for attention!

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