



Boiler 1 (P1) at Stegeholsverket in Västervik Sweden, was equipped with an Ecotube-System in 2014 in order to reduce emissions of NO_x and also to reduce and stabilize emissions of CO. Boiler 1 is a biomass fired BFB-boiler dating from the 1980s and is used primarily during cold winter months to support heating demand from the district heating net. ECOMB engineered and designed an FGR system that the client installed during 2009/10 as a first step in order to reduce NO_x emissions. NO_x emissions were reduced by 20-25% by adding FGR to the current secondary air system. To use the full potential of the FGR-system one Ecotube was installed to reduce emissions of CO so FGR-flow to the secondary air system could be increased. Higher FGR-flow to the secondary air system reduced formation of NO_x further but naturally increased emissions of CO.



With the Ecotube in operation, installed just before the boiler exit, downward high pressure air jets from the Ecotube changes the flue gas flow pattern thus increasing residence time and mixing but also improving temperature distribution across the boiler width etc. NO_x emissions were reduced by a further 35% with increased FGR flow in combination with the Ecotube at comparable or improved CO-emissions. The Ecotube can in the future if required supply liquid urea, anhydrous or liquid ammonia to meet future emission demands.

Plant:

Plant owner:

Boiler:

Purpose of installation:

Year of installation:

Operating time:

Power output:

Steam output:

Fuel:

Stegeholsverket Västervik

Västervik Miljö&Energi AB

P1, BFB, Biomass

NO_x and CO Reduction

2014

1000-3000 hours/year

10-20 MWth

District Heating Boiler

Biomass

Pre Ecotube and FGR Emissions*

NO_x

CO

* All values correspond to mg/Nm³ @ 6% O₂

280-300

<500

Post Ecotube and FGR Emissions*

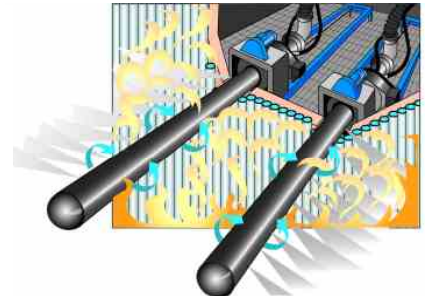
NO_x

CO

140-150

<500

The Ecotube system optimizes the combustion process in boilers. Ecotubes are retractable lances which penetrate the boiler furnace wall and are equipped with injection nozzles. The Ecotube system supplies a small proportion of the combustion air under high pressure through the high velocity nozzles. Injection of high velocity air streams creates radically improved **mixing** of the partially burned combustion products, so enabling efficient completion of combustion and significantly reduced emissions of pollutants like NO_x and unburned components – CO, VOC (Volatile Organic Compounds), particles etc. Improved mixing enables the boiler to run at a lower air/fuel ratio, thus resulting in a higher thermal efficiency. Another important feature is the opportunity to increase thermal output of the boiler.



ECOTUBES also supply either solid or liquid urea, anhydrous or liquid ammonia for DeNO_x or limestone for DeSO_x.

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