



# Installation of the Ecotube System at Västervik Miljö&Energi AB, Sweden



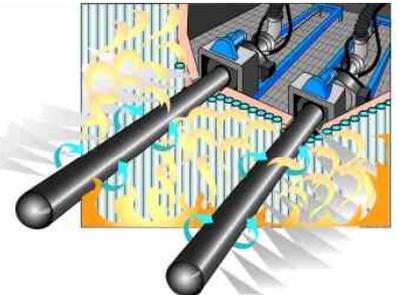
Boiler 1 (P1) at Stegeholsverket in Västervik Sweden, was equipped with an Ecotube-System in 2014 in order to reduce emissions of NO<sub>x</sub> and also to reduce and stabilize emissions of CO. Boiler 1 is a biomass fired BFB-boiler dating from the 1980s and is used primarily during cold winter months 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<sub>x</sub> emissions. NO<sub>x</sub> 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<sub>x</sub> 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<sub>x</sub> 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.

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| <b>Plant:</b>                          | Stegeholsverket Västervik   |
| Plant owner:                           | Västervik Miljö&Energi AB   |
| Boiler:                                | P1, BFB, Biomass  |
| Purpose of installation:               | NO <sub>x</sub> and CO Reduction                                  |
| Year of installation:                  | 2014  |
| Operating time:                        | 1000-3000 hours/year  |
| Power output:                          | 10-20 MWth  |
| Steam output:                          | District Heating Boiler   |
| Fuel:                                  | Biomass   |
| <b>Pre Ecotube and FGR Emissions*</b>  | * All values correspond to mg/Nm <sup>3</sup> @ 6% O <sub>2</sub> |
| NO <sub>x</sub>                        | 280-300   |
| CO                                     | <500  |
| <b>Post Ecotube and FGR Emissions*</b> |   |
| NO <sub>x</sub>                        | 140-150   |
| CO                                     | <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<sub>x</sub> 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<sub>x</sub> or limestone for DeSO<sub>x</sub>.**

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