

Hitachi Zosen INOVA

A LEAP forward: The HZI Low Excess Air Process
Highly efficient combustion with low O₂ and low NO_x



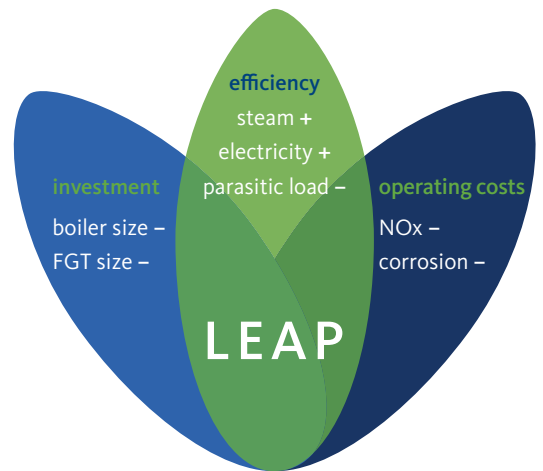
A LEAP forward: the HZI Low Excess Air Process

LEAP: Maximized efficiency, minimized operating costs and a significant reduction of plant size – Hitachi Zosen Inova’s new process with low excess air kills three birds with one stone by optimizing the heart of your plant: the combustion process (patent pending).

Using less air to combust the waste and at the same time reducing your plant’s corrosion potential sounds like a fair swindle? It isn’t. Our new process reduces the combustion air flow rate by 15–20 %, allowing your boiler to be 5 % smaller, and your flue gas treatment 5 to 25 % smaller, depending on its setup. As a side effect, the even distribution of corrosive agents by intense mixing reduces the risk for corrosion even at lower oxygen levels. With LEAP, the three pillars of cost reduction are effectively improved: efficiency, operating costs, and capital investment.

Fundamentals of the process:

- Waste LHV above 9.5 MJ/kg
- Flue gas recirculation
- (Local) cladding of boiler walls
- 2-stage injection of secondary air (SA) and recirculated flue gas (RFG)



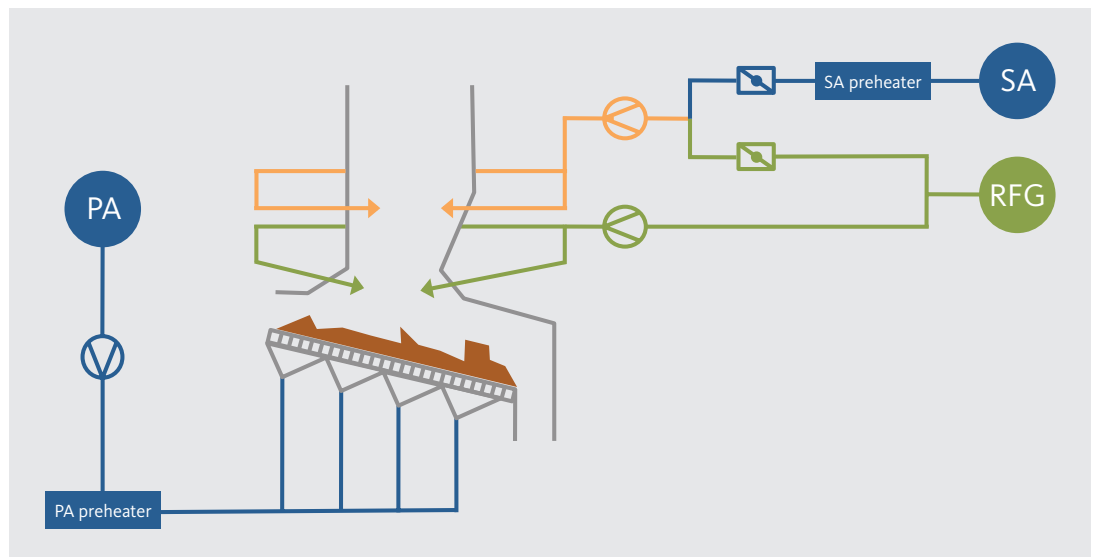
Benefits of the Low Excess Air Combustion Process

Description of a typical setup

The typical setup consists of two injection steps to completely combust the primary gas stemming from the grate.

Stage 1: Mixing and partial combustion: Straight injection of RFG.

Stage 2: Full combustion: Swirl injection of premixed SA and RFG.



Typical setup of the HZI Low Excess Air Combustion Process. PA = primary air, SA = secondary air, RFG = recirculated flue gas

The advantages of this design:

- Staged combustion reduces local maximum temperatures
- RFG mixes the primary combustion gas from the grate and causes gradual oxidation
- The SA/RFG mixture in the 2nd stage avoids high local temperatures due to a lower O₂ content than air alone
- The staged combustion, the use of RFG and the lower O₂ content all lead to a reduction of uncontrolled NO_x formation
- Higher degree of control possibilities: RFG in 1st stage to influence fire start by controlling radiation intensity, SA/RFG mixture in 2nd stage to maintain constant injection momentum over a wide range of control deviations and load points
- Flue gas flow rates after RFG extraction are reduced by up to 20% resulting in smaller plant components

In the first stage, the primary gas from the grate is mixed and partially combusted with RFG. Typically, the primary gas from the grate on the ram feeder side contains no residual oxygen, but is rich in CO, CO₂, hydrocarbons, NO_x precursors and H₂ (area A, see below).



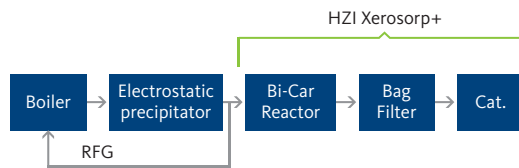
On the bottom ash discharge side, it is essentially unused air (area B).

These two fractions are effectively mixed and partially combusted with the injection of recirculated flue gas. The second stage then fully oxidizes the homo-genized gas from stage 1.

Example: Efficiency Gain

The actual savings with LEAP depend on the process setup. One example shall illustrate the average potential.

Base Case: 1 Line, 62 MW_{th}
8 vol% O_{2, dry}, with the following setup:



- With LEAP: 4.5 vol% O_{2, dry}
- Live steam: +1.5 MW (+2.75%)
- Electricity production: +390 kW (+2.6%)
- Reduction of parasitic load for fans: -85 kW
- Reduction of NH₄OH for catalyst: -30%

Based on € 50/MWh and € 0.20/kg NH₄OH, the estimated annual savings per line are € 215 000.

And Corrosion?

While it is often argued that a low O₂ combustion process will increase corrosion rates, this does not apply to our process: we keep the superheater inlet temperature at the same level as with a conventional process, and avoid high local concentrations of corrosive agents with our intense 2-stage mixing. Actual measurements revealed that the maximum local concentration of CO (as an indication of mixing in the 1st boiler pass) was up to 100 times smaller with our 2-stage injection.

Key advantages of the low excess air combustion process:

- Maximized efficiency
- Minimized parasitic load
- Minimized investment costs (new plants) or increase of power (retrofit)
- Optimum control possibilities
- Uniform temperature and concentration profiles

LEAP: Maximized efficiency, minimized running costs, lower capital investment

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