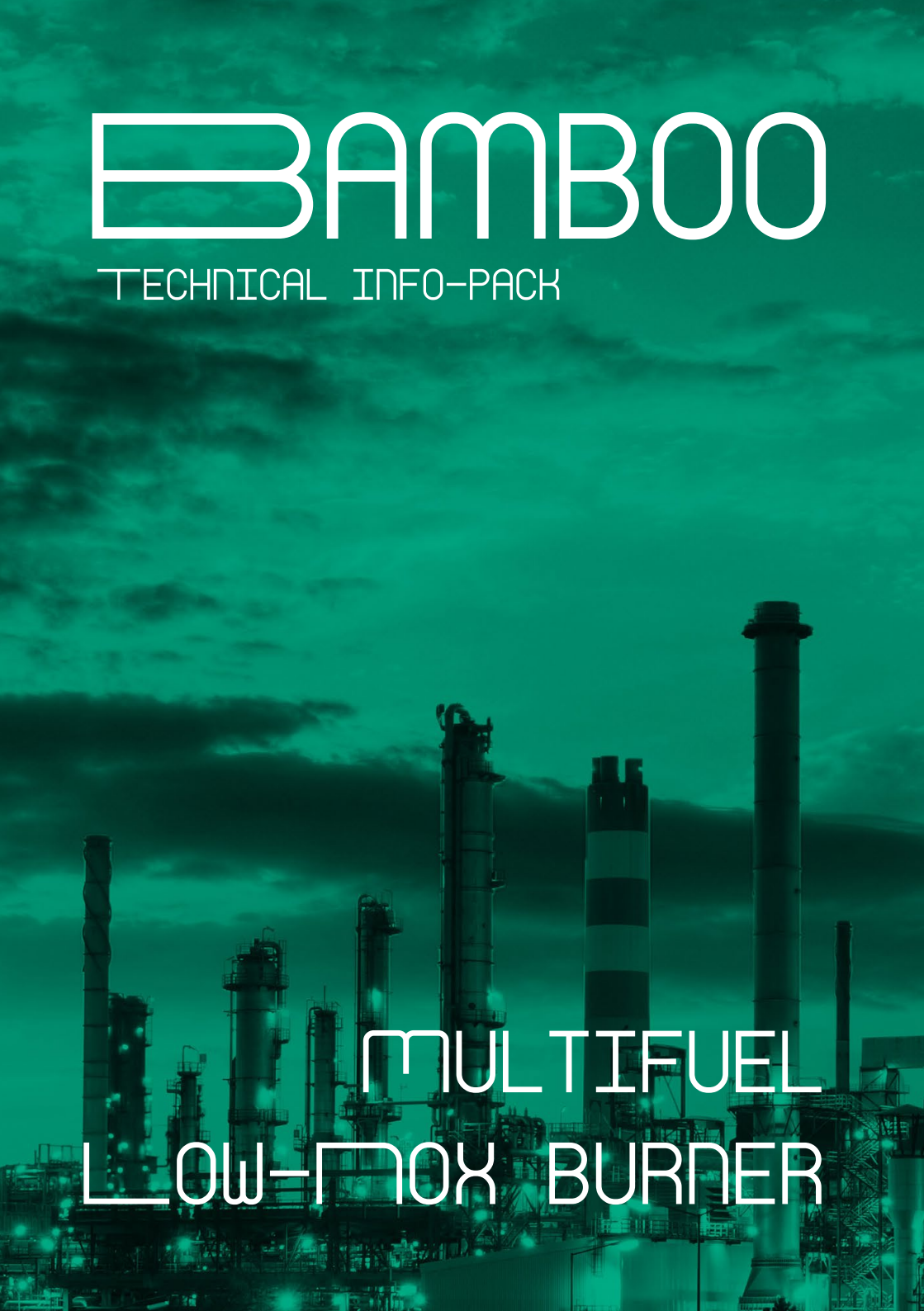
# BAMBOO

TECHNICAL INFO-PACK



# MULTIFUEL LOW-NOX BURNER



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## Low-NOx Burner technology application reduces peak temperatures and NOx emissions

## DESCRIPTION

Low-NOx Burner (LNB) is a technology designed to reduce the production of nitrogen oxide by controlling fuel anhe peak flame temperature relative to premix and conventional burners.

An existing commercial Low-NOx Burner was modified for the introduction of agro-forestry biomass residues as fuel and it was applied in the magnesites sector. The adapted technology is more energy-efficient, helps reduce emissions, and can produce the necessary high temperatures to calcine and sinterise the magnesite.

The new, more versatile LNB has been designed to best couple the needs of the magnesite sector. It can reach e the high temperatures needed for dead burnt magnesite (DBM) production, which had been one of the main obstacles up until now. This new burner required some modifications

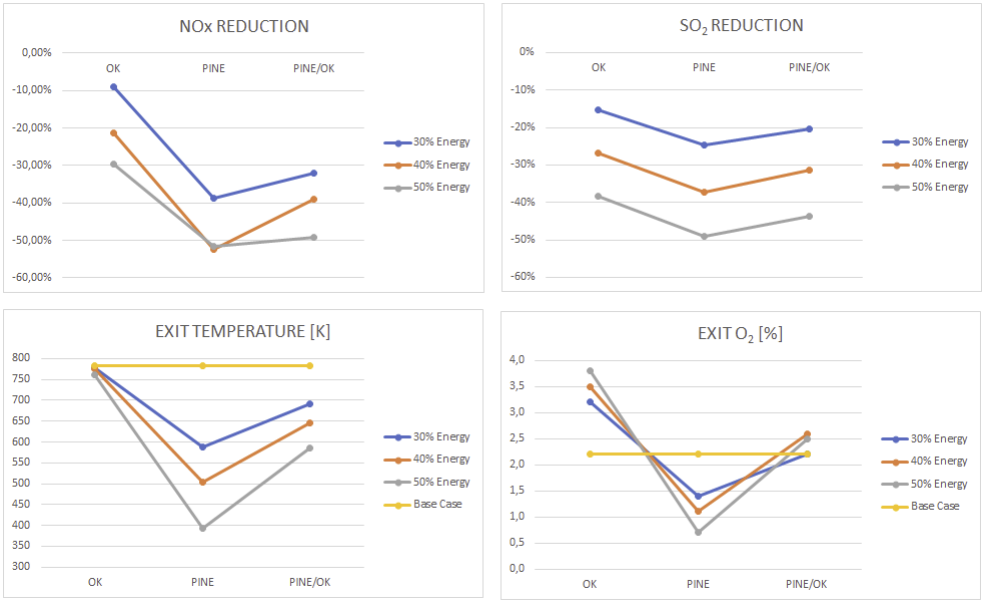


**Figure 1.** Predictions of the DT for the emissions, temperature and oxygen at the exit of the fumes for several scenarios of biomass substitution

which will usher in a technology that reduces peak temperatures while maintaining the fuel features. This will ensure the quality and the flexibility of production, and reduce NOx emissions at the same time.

The fuel flexibility is aided by the development of a digital twin (DT) of the kiln. This DT is based on realistic physical simulations using computational fluid dynamics (CFD). The result of the simulation is the complete physical state of the kiln in terms of temperature distribution, gas composition, velocities, and other quantities of interest.
The DT can predict how a certain blend of fuel (mix of coke and biomass) will impact the operating conditions and emissions; this evaluation will state if the blend can be used or not. The DT can alternatively be used to evaluate:

- biomasses' right properties to be an adequate fuel;
- the degree of coke substitution.

The DT can be upgraded to new biomasses by running additional simulations. Similarly, physical changes to the burner could be considered. Thus, this tool can be periodically updated.

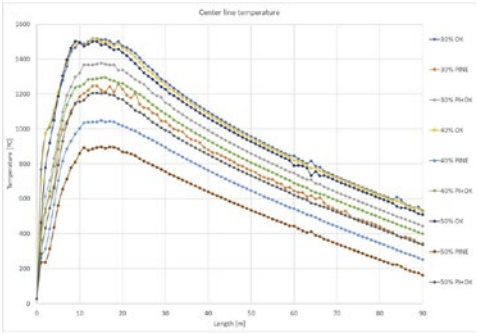


**Figure 2.** Predictions by the DT for the profile of temperature in the centreline of the kiln for several scenarios of biomass substitution

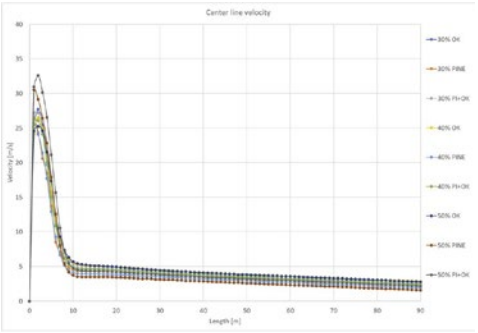


**Figure 3.** Predictions by the DT for the profile of velocity in the centreline of the kiln for several scenarios of biomass substitution

## POTENTIAL MARKETS AND END-USERS

Energy supply, agriculture and the manufacturing and extractive industries are the main sources of NOx emissions in the EU, with a great potential for NOx reduction, especially in the metal, non-metallic mineral, chemical, paper, and wood sectors.

As part of global efforts to reduce GHG emissions, energy efficiency measures for industrial burners will make a significant impact on NOx emissions and aggregated energy saving in industries. Such interventions are expected to bring 8.1% energy savings overall in the manufacturing industry by 2030.

The average NOx removal with LNB is around 30%, with peaks up to 50%. The energy-saving potential of efficient burners is higher for iron and steel, non-metallic minerals, aluminium and copper, and coke and petroleum. Less impact is shown for chemical and petrochemical, food, and machinery.
The most promising sectors for the uptake of low NOx burners are the cement & lime industry, magnesite, iron and steel.

## RESULTS

Thanks to the implementation of the LNB system, Grecian Magnesite (GM) has drastically reduced NOx emissions by over 40%. At the same time, when part of the fuel (pet coke) is replaced by biomass (sunflower husk pellets), NOx emissions were further decreased by 21%, while SOx emis-

sions were reduced by 47%. The ratio of substitution was 2 to 1 by weight, which corresponds to a contribution of biomass to the energy potential of the final fuel that reaches 50%. The fuel mixed with biomass has varied its characteristics, by reducing its calorific value and increasing the percentage of moisture and ash, which, however, did not create any issues in the operation and efficiency of the burner.

The effective application of co-firing technologies, especially in such operating conditions, is a big step towards reducing emissions in the heavy industry sector. At the same time, it proves that the use of fossil fuels can be cut without altering the functionality and efficiency of processes that require large amounts of energy, extremely high temperatures, and high-quality of final products. The further replacement of pet coke by biomass as well as the development of more environmentally friendly burners are subjects of further study and also an attractive target for GM and other industries in the magnesia sector.

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