



FFPLUS SUCCESS STORY: BUSINESS EXPERIMENTS

HPC-BASED EFFICIENCY OPTIMISATION OF INDUSTRIAL FIRED PREHEATERS

ORGANISATIONS

KALFRISA specialises in industrial heating systems that improve energy efficiency and reduce emissions across energy-intensive sectors. **nablaDot** supply engineering expertise in simulation, AI, digital twins and industrial optimisation. **The University of Zaragoza-BIFI Institute** operates Aragón's largest research computing centre and provides expertise in high-performance computing and advanced scientific modelling.



THE CHALLENGE

Industrial operators must reduce energy use, emissions and maintenance costs while adopting alternative fuels and maintaining reliability. For KALFRISA, traditional fired-preheater design methods could not deliver the accuracy or flexibility demanded by customers. Creating digital twins required thousands of high-fidelity CFD simulations whose computational and memory demands exceeded conventional engineering systems, making HPC essential.



Technology used: HPC, ML, CFD
Industry Sector: Energy

THE SOLUTION

The IGNITE experiment developed an HPC-enabled digital twin platform for industrial fired preheaters. Large-scale CFD simulations of combustion, heat transfer and fluid flow were executed to generate validated datasets across multiple fuels, operating conditions and equipment configurations. These datasets trained AI and reduced-order models that deliver near real-time performance predictions, enabling optimisation, design assessment, degradation forecasting and predictive maintenance.

THE IMPACT

IGNITE strengthens KALFRISA's competitive position by expanding its portfolio from equipment supply into higher-value digital services, including optimisation, performance monitoring and predictive maintenance. The project establishes a scalable collaboration model with nablaDot, combining industrial expertise with advanced digital engineering capabilities.

HPC-enabled digital twins allowed customers to evaluate operating strategies, fuel transitions and equipment upgrades faster and with lower risk. The solution supports improved reliability, more efficient thermal processes and accelerated adoption of low-carbon fuels such as hydrogen.

By enabling data-driven optimisation across energy-intensive industries, the project contributes to industrial digitalisation, reduced energy consumption and lower emissions while creating new commercial opportunities for both SMEs.

BENEFITS

- The models improve fired preheater efficiency by 5–15% through continuous optimisation.
- Reduced thermal energy consumption by 10–35% and lowered emissions.
- Maintenance costs reduced by 20–30% through predictive maintenance.
- Unplanned downtime reduced by 20–40% using Remaining Useful Life forecasts.
- New digital-service revenue opportunities for KALFRISA and nablaDot.



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