FF4EuroHPC Success Story

High-Fidelity Modelling of a Hydrogen-Fired Industrial Combustor

Organizations

EM Combustion is a Spanish SME that develops customized solutions for industrial combustion systems. The application fields include energy, oil and gas, steel and metal industries.

Barcelona Supercomputing Centre (BSC) is the National supercomputing facility in Spain. The BSC team involved in the Propulsion Technologies Group develops computational models for power and propulsion applications.

End User

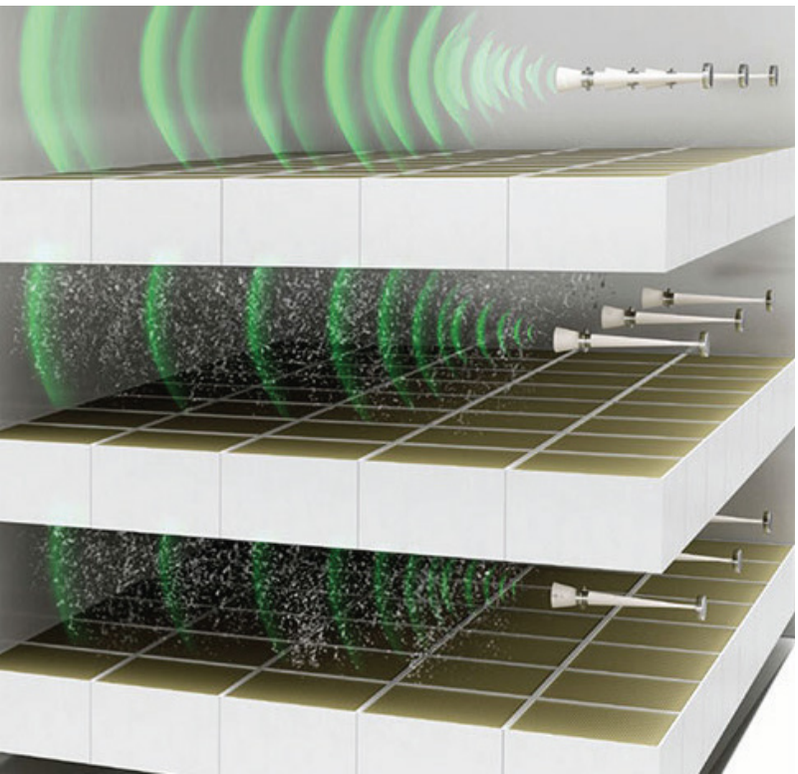
HPC Provider & Expert

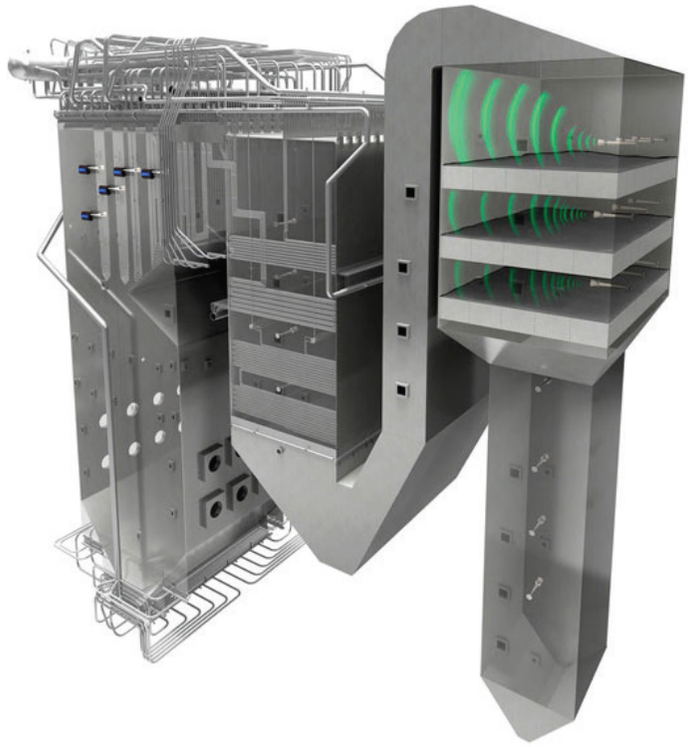
Barcelona Supercomputing Centre is part of the Spanish NCC.

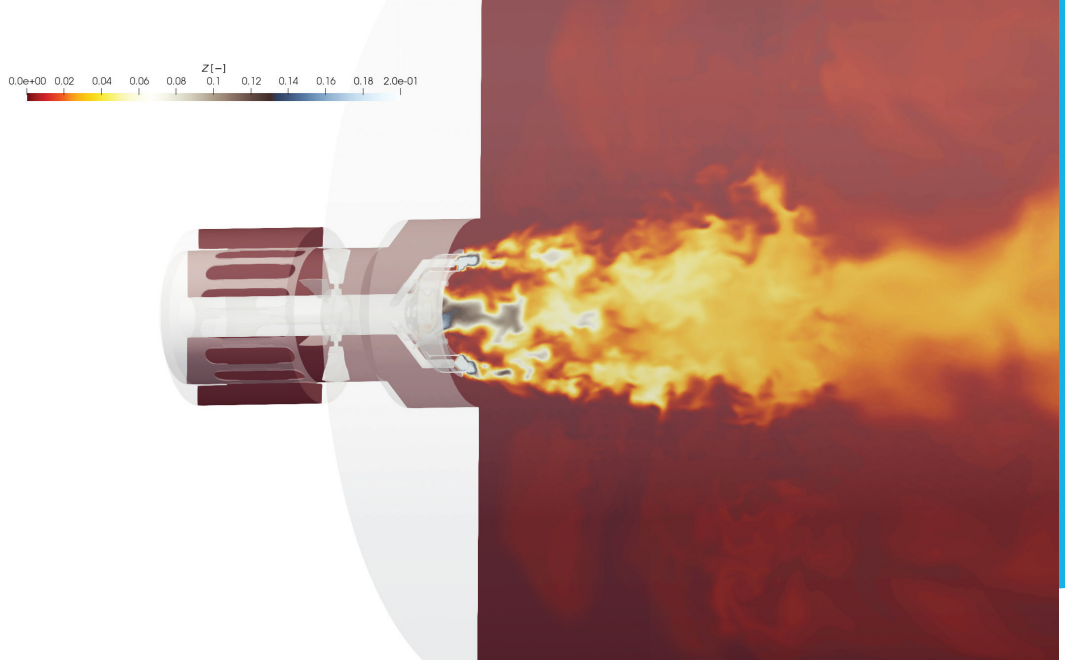
The Challenge

EMC develops burners for energy production plants. EMC burners can operate with all types of liquid and gaseous fuels from diesel or natural gas to alternative fuels.

The EU commitment to achieve net-zero greenhouse gas emissions by 2050 is driving the power generation industry to prioritise the development of low-carbon technologies. Among different solutions, green hydrogen and hydrogen-enriched fuels have a significant potential to enable the transition to a clean, low-carbon energy system. This transition to more energy-efficient, lower pollution emitting, (particularly considering NOx) power generation systems creates challenges for all industries in the market and in particular for SMEs. Digitalization based on advanced HPC-enabled simulations is the key to increasing EMC's competitiveness.







Industry Sector
Energy

Technology used:
HPC,
CFD Simulations

The Solution

The experiment developed a platform for virtual testing of industrial combustors using HPC to obtain quantitative information about combustion performance in terms of combustion dynamics, pollutant formation, and burner operability for hydrogen-enriched fuels.

This platform is integrated with EMC's design and optimization cycle for its new low-NOx injectors for hydrogen-enriched mixtures. The experiment combines physical tests and high-fidelity numerical simulations, with the goal of accelerating the deployment of low-carbon power generation while reducing the design cycle duration and costs. This is possible only thanks to HPC since combustion simulations are prohibitively slow on non-HPC systems.

The Impact

EMC can benefit from a computational platform for virtual testing of industrial combustors using HPC via the following business impacts:

- EMC will save significant costs associated with traditional physical testing. It reduces the need for expensive prototypes, testing equipment, and specialised personnel. The estimate of savings in the design cycle of a new combustor is around €50,000.
- With virtual testing, EMC can accelerate the development of new industrial combustors, achieve faster time-to-market, gain a competitive advantage, and increase its market share. Estimations show that around 4 to 6 months of testing time could be saved.
- Enhanced innovation: The computational platform can allow EMC to test new and innovative designs of industrial combustors that may not have been feasible with traditional testing methods, reducing fossil consumptions and emissions.

Benefits

- Shortening time-to-production and time-to-market by 20%.
- Gaining hydrogen technology know-how, reducing maintenance costs by 25% with numerical simulation.
- Expanding EMC's consultancy offer, generating €100K in the first year, increasing turnover by 5%.
- Starting the digitalization of burner design, reducing design costs by 30% and worker costs by 5%.