FF4EuroHPC Success Story

Solving Ambitious Challenges in Wastewater Treatment Using HPC in CFD Simulation

Organizations

AeroFEM GmbH is a Swiss SME in the aerospace sector. It offers engineering and consultancy services for a wide range of industries.
TK Consult AG provides integrated water management, hydraulic engineering, and geothermal energy services.
HOLINGER Ingenieure GmbH operates in urban water management, energy, and environment.
Elkuch Group is one of the leading suppliers of waste collection and wastewater treatment systems.
HLRS, University of Stuttgart is one of the three national supercomputing centres in Germany.

End Users

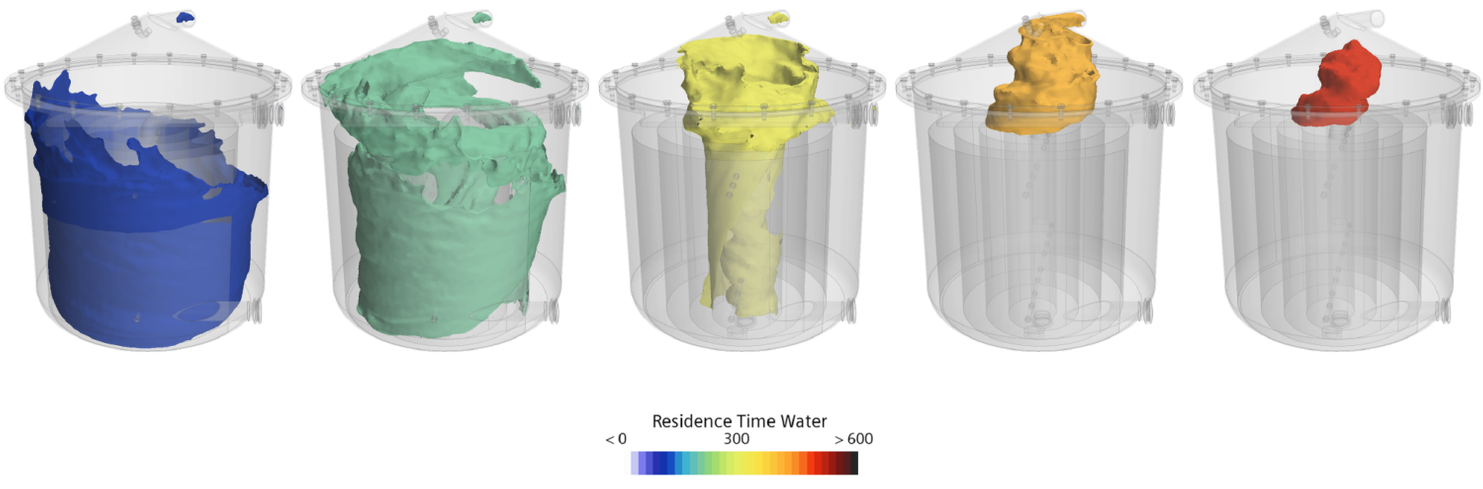
Technology Experts

HPC Provider

HLRS is part of the German NCC.

The Challenge

Europe's freshwaters are increasingly polluted through waste: improper drug disposal generates pharmaceutical pollution; solid waste decomposes and creates micro-pollutants. The 2021 EU regulation will drive operators to upgrade their facilities for higher wastewater quality, with annual investments estimated to approach €4 billion. This provides a business opportunity for the experiment's companies by exploiting digitalization for technology offerings and improved water management.



Industry Sector
Environment

Technology used:
HPC,
CFD Simulation

The Solution

Two high-end purification technologies - ozonation and pressure floatation - were considered. While ozonation covers pharmaceutical pollution and is more novel, pressure flotation actively deals with solid suspensions and micro-pollutants, complementing the more passive sedimentation in tanks or basins.

Each technology solution will be managed through a digital twin considering the system's CAD geometry and the CFD simulation model of the purification technique. Based on suitability and accuracy, validated methods are applied to the simulation model for physics and chemistry.

An HPC-based workflow is provided to empower SME user processes through efficient systems-/ process scaling and optimisation. HPC use is essential to allow turnaround of the simulations consistent with the users business processes.

The Impact

The innovative IT solution provides all participating companies with a competitive advantage in wastewater management and other related sectors, which represents a massively growing market. This should provide a major incentive for other SMEs and start-ups to take up the technology and enter that market.

HPC Centres benefit significantly from an additional demand for HPC resources to cut design and construction turnaround times with new SME customers using their resources to run efficient optimisation cycles.

Eliminating pharmaceutical contamination from water reduces the risk of antibiotic resistance while removing micropollutants reduces the risk of health-damaging effects caused by potentially trapped and accumulated micro particles in different tissues and organs, such as lungs or placenta. Overall trapping and accumulation of residues of pharmaceuticals and micropollutants in our global environment as well as the whole human food chain will decrease.

Benefits

- The customised digital workflow, including validated simulation models tailored to the needs of the design process, speeds up turn-around times by 50–70% compared to current workflows.
- New strategic services in the portfolio of AeroFEM GmbH and TK Consult AG generate expected growth of 20-40% in total sales of consulting services and software.
- Ludwig Elkuch AG and Holinger GmbH expect a growth of 30-50% in sales of systems and building services.
- Federal and municipal authorities expect savings in public construction projects of 30-40% compared to current costs.
- Federal/municipal authorities will build strategic alliances with their contractors to cost-effectively master this massive undertaking.