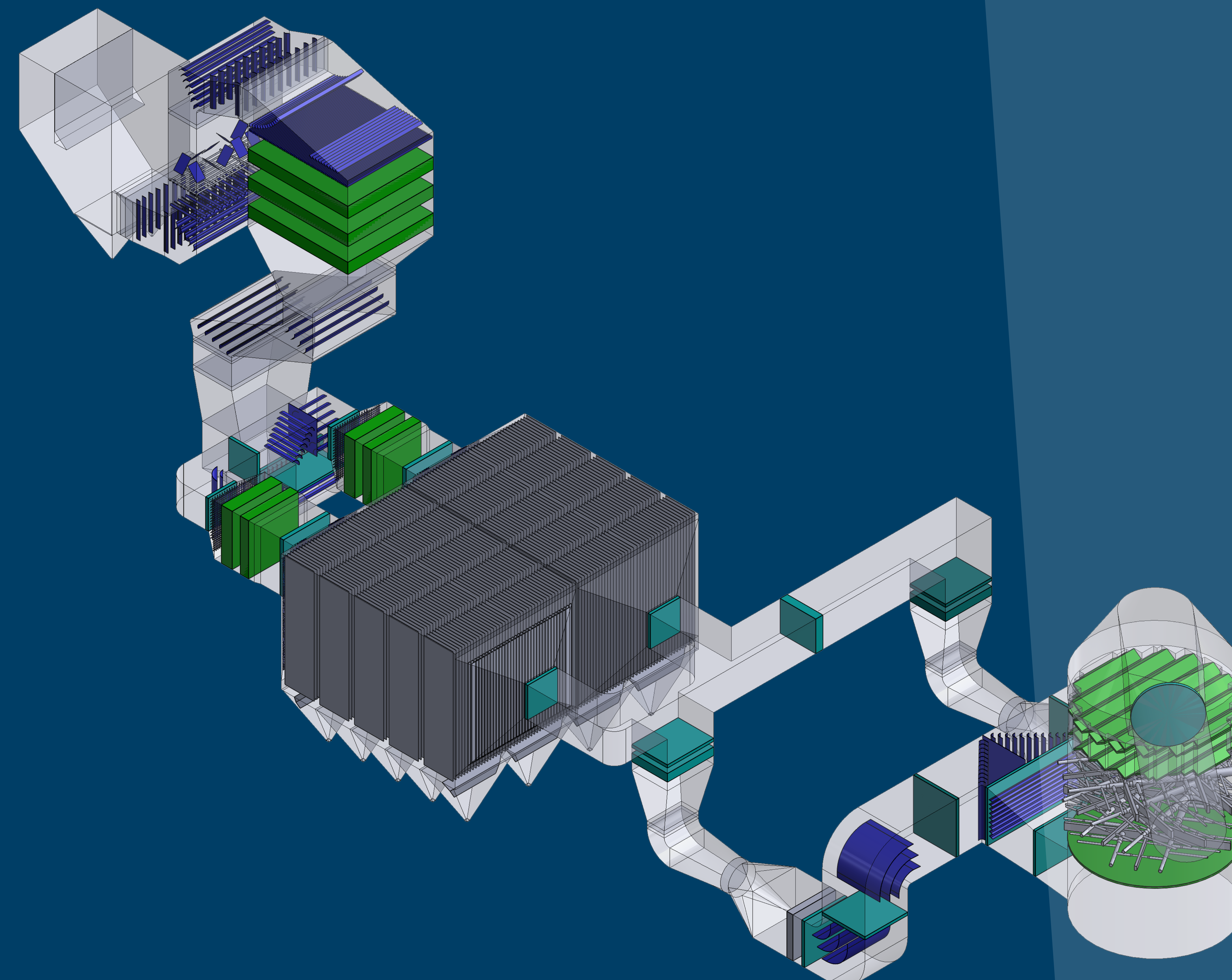
MINIGUIDE

Using CFD to reduce emissions at maximum efficiency



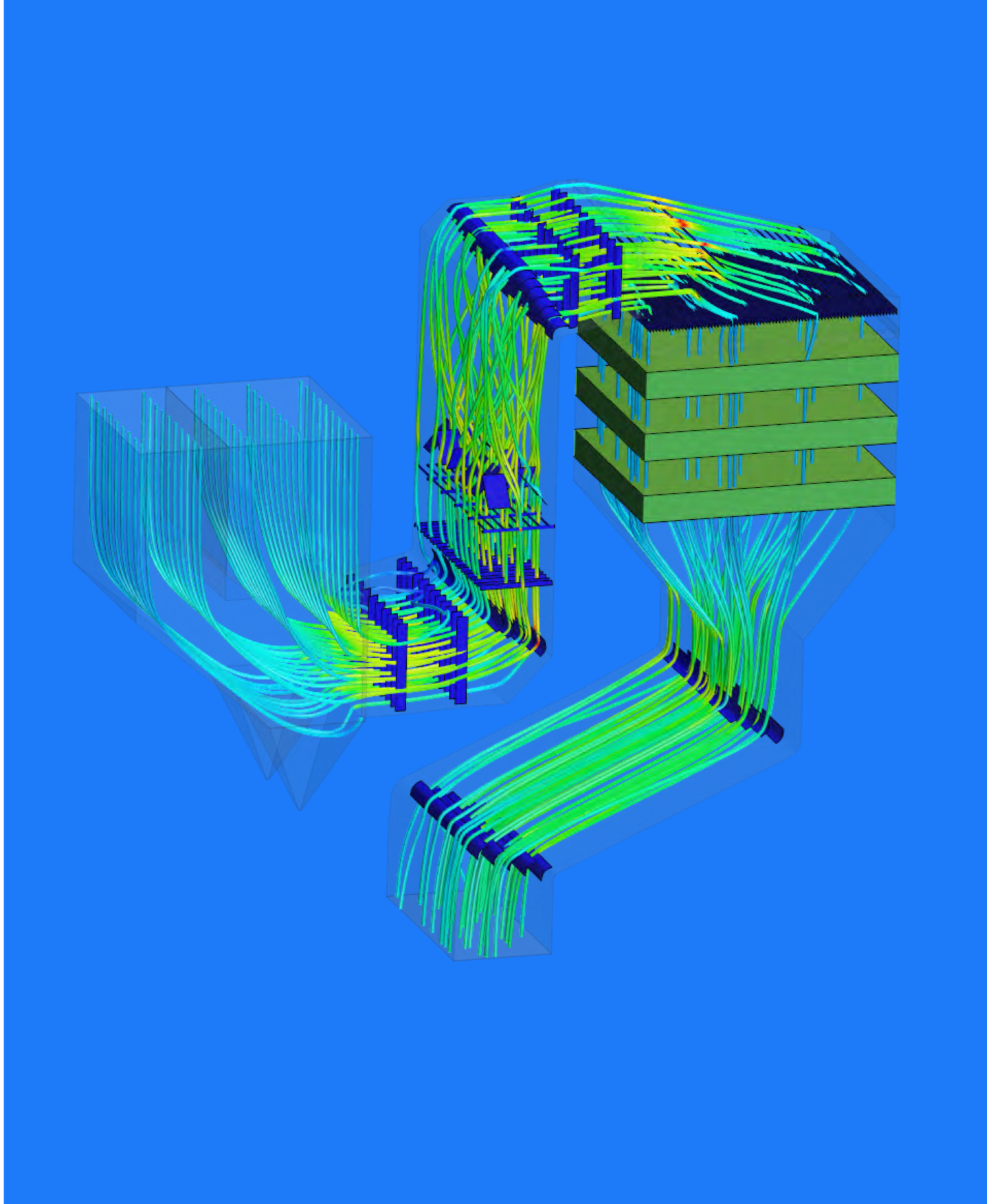
01

Guide to emission reduction at maximum efficiency with CFD

In today's world, the emission of flue gases is a trending topic that has power plants from all over the world, looking for solutions on how to reduce them.

The motivation to install emission reduction technologies, lies in the need to comply with environmental regulations. However, use of these technologies can represent a major challenge to power plants, when it comes to capital and operating expenses.

This guide introduces various ways CFD (computational fluid dynamics) can help power plants ensure that their emission reduction is performed at maximum efficiency. If the flow in the flue gas cleaning unit is not optimised the power plant may discover difficulties complying with environmental regulations.



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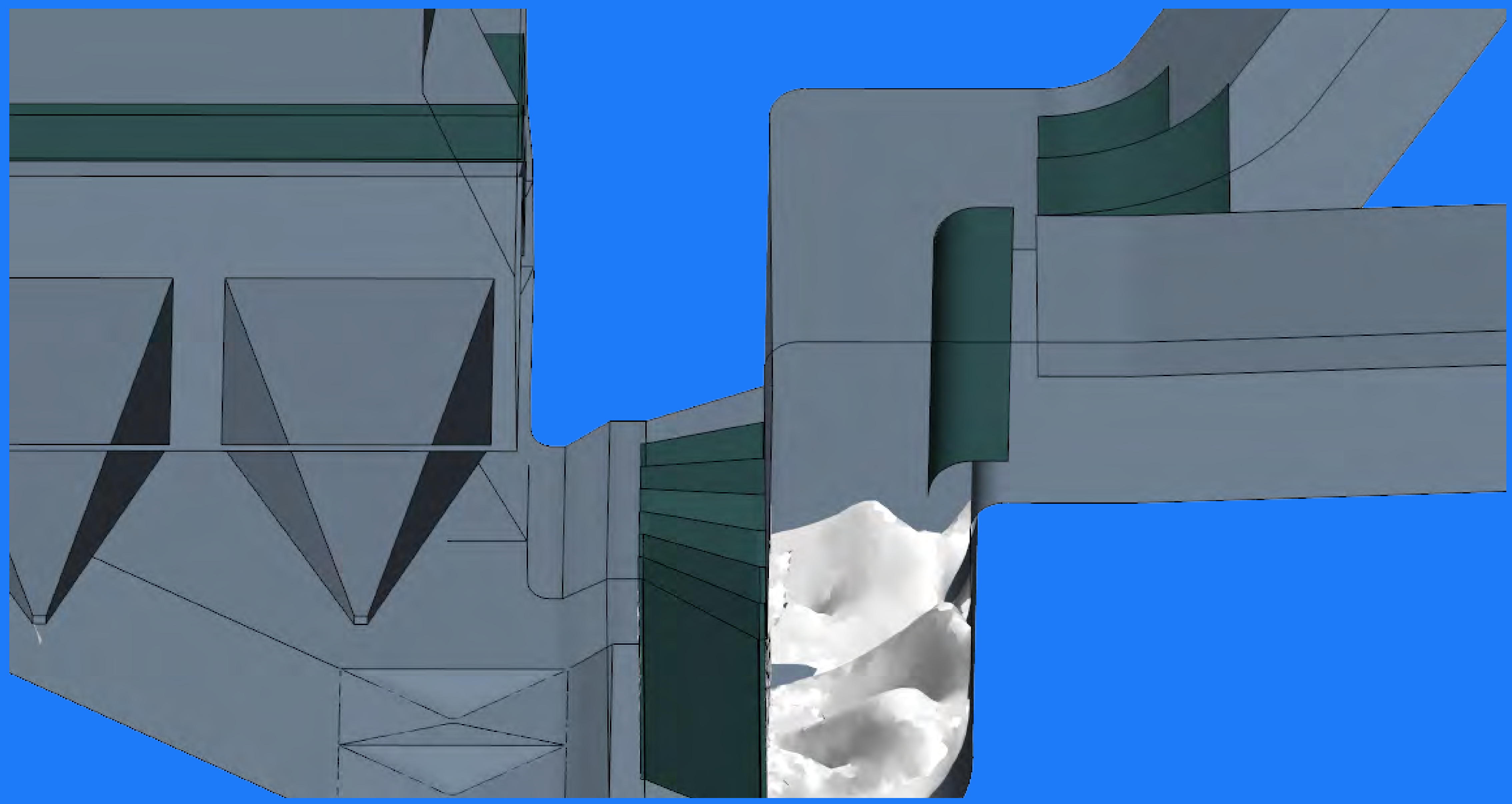
Issues that lead to non-optimal flow conditions

Normally, emission reduction units operate at maximum efficiency when subject to optimal flow conditions. But in real life, flow conditions inside these units are not optimal, which in turn leads to poor efficiency, and higher operating costs to comply with environmental regulations.

On occasion the power plant may even learn that there is a mismatch between the original design of the flue gas unit and the actual design installed.

Non-optimal flow can also lead to:

- dust accumulation
- erosion problems
- reduced operation lifetime
- excessive consumption of ammonia, slurry or any other cleaning substance
- increased capital expenses related to troubleshooting and replacements.



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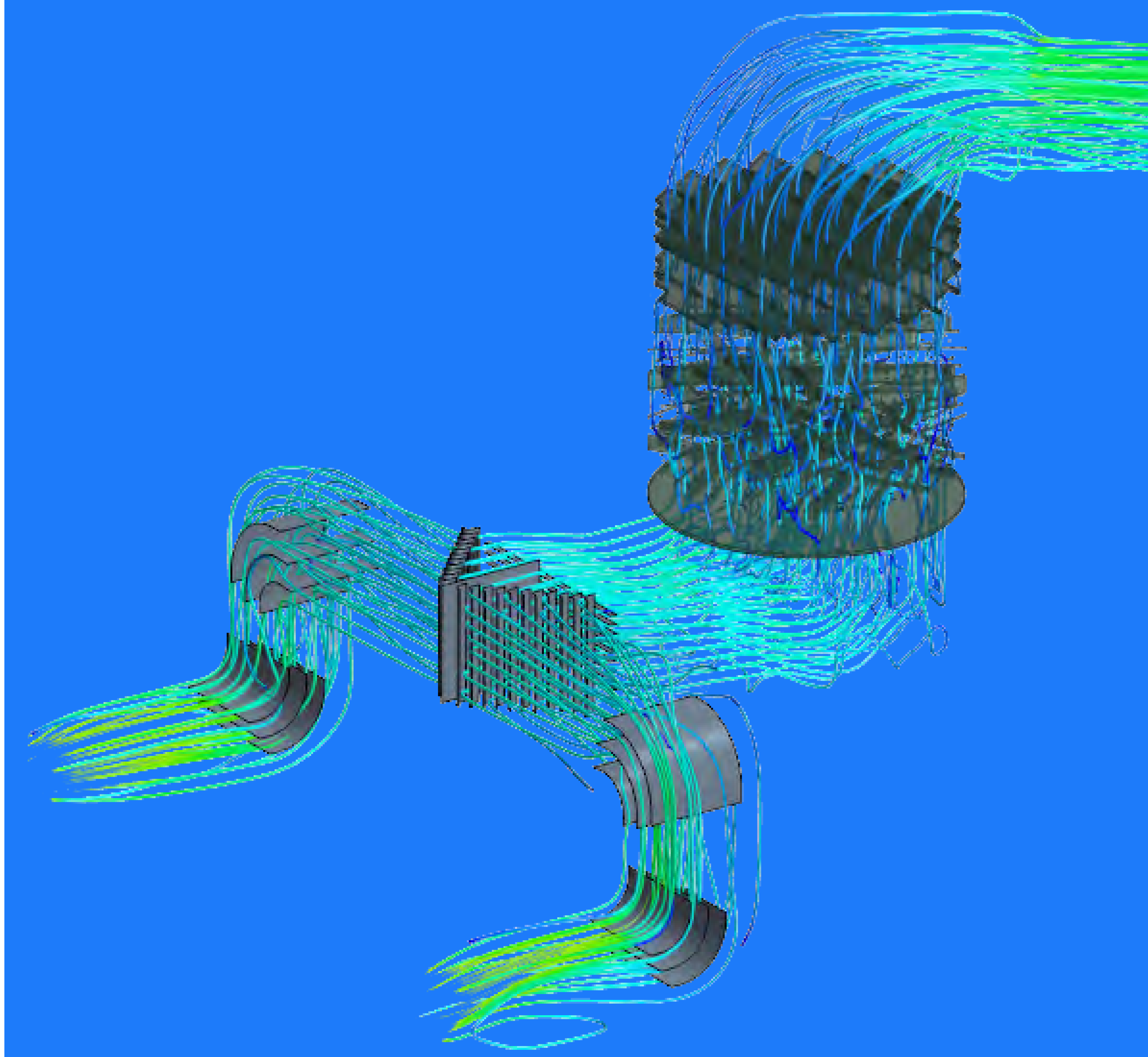
How can power plants benefit from using CFD?

CFD (computational fluid dynamics) is a tool that allows deep understanding of flow behaviour inside the emission reduction unit.

This understanding makes it easy to identify flow problems that are causing poor efficiency and high operating costs.

Solutions can be proposed, and their validity tested, prior to implementing them. This method allows creating flow conditions for maximum efficiency, thus minimising both operating and capital expenses and gives a solid basis for decision before implementing suggested changes.



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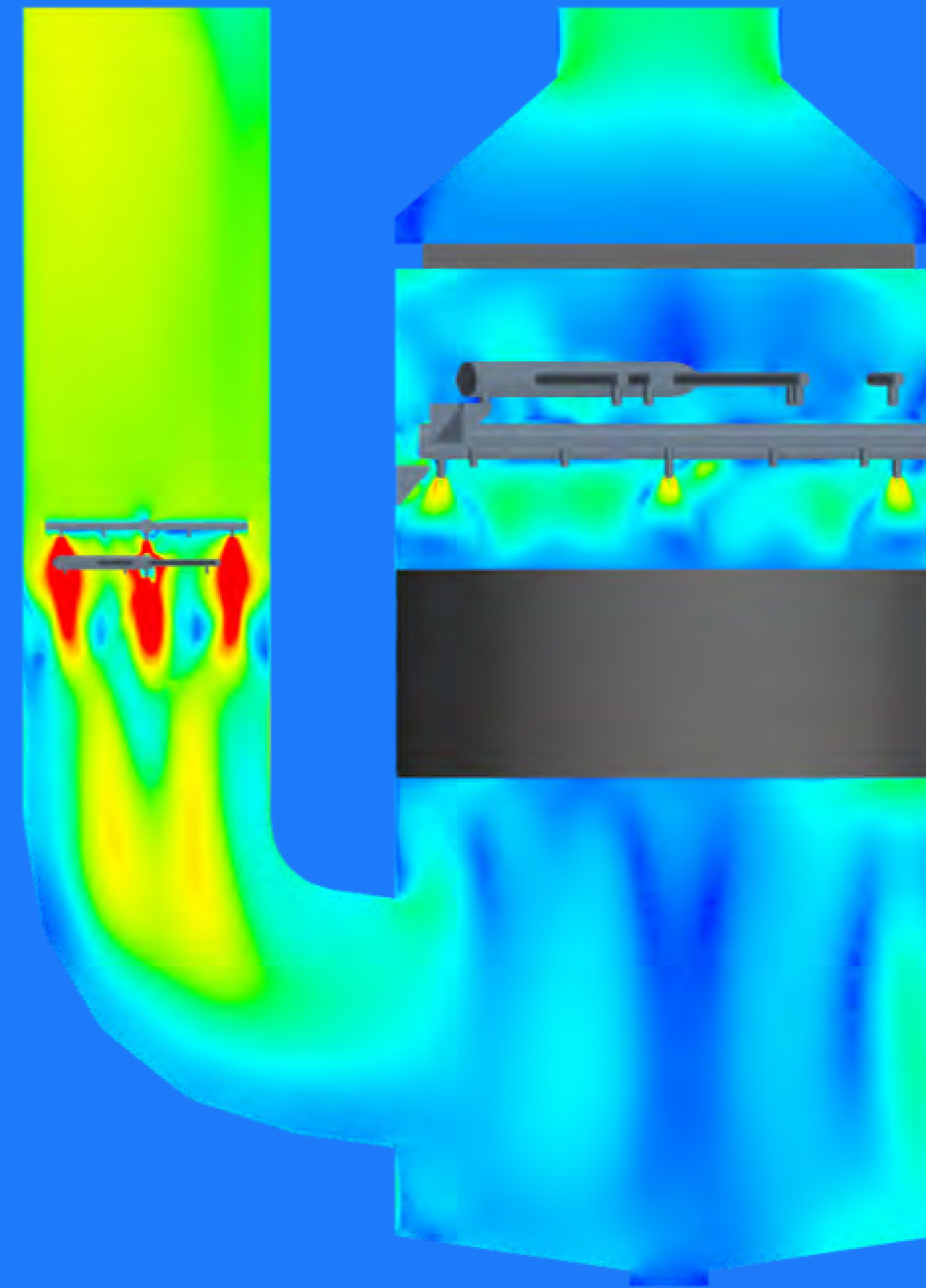
What does it take to do a CFD optimisation?

Access to CFD software and enough computational power is required for CFD flow calculations. Multiple CFD software can be used for the flow optimisation process and Star-CCM+, Ansys CFX and Fluent are among the most used ones.

Lack of sufficient computational power is one of the strongest limitations of doing CFD, due to their high cost. However, many CFD calculations cost considerably less than running an inefficient emission reduction process.

To create a CFD model that properly represents a physical system, expert knowledge both of fluid mechanics, the used CFD software and 3D CAD geometry is required. Also, sufficient knowledge on the physical emission reduction system and operating conditions is necessary.



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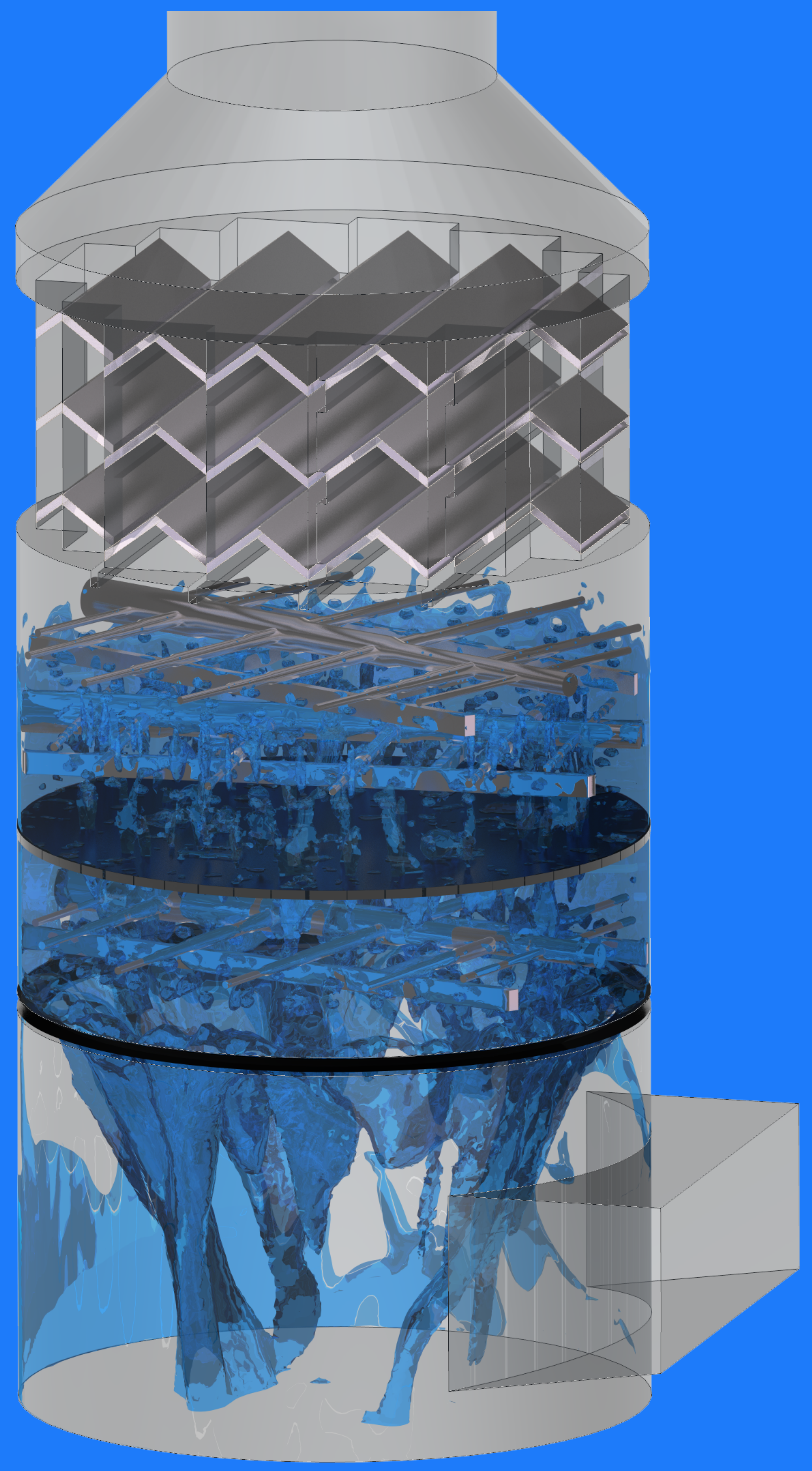
Increase the efficiency of the emission reduction unit

Improving the flow distribution inside the cleaning unit, allows necessary chemical reactions and heat transfer processes, to occur optimally. Optimal performance of these processes translates itself into better cleaning efficiency.

Optimised solutions ensure not only high cleaning efficiency under all loads and operating conditions, but also optimal performance, larger lifetime and reduced operational cost of units, through:

- Optimisation of flow distribution
- Optimisation of injection systems
- Improvement of mixing
- Reduction of pressure drop
- Minimising necessary cleaning substance
- Reduced risk of erosion
- Reduced risk of dust accumulation
- Minimized recirculation areas.



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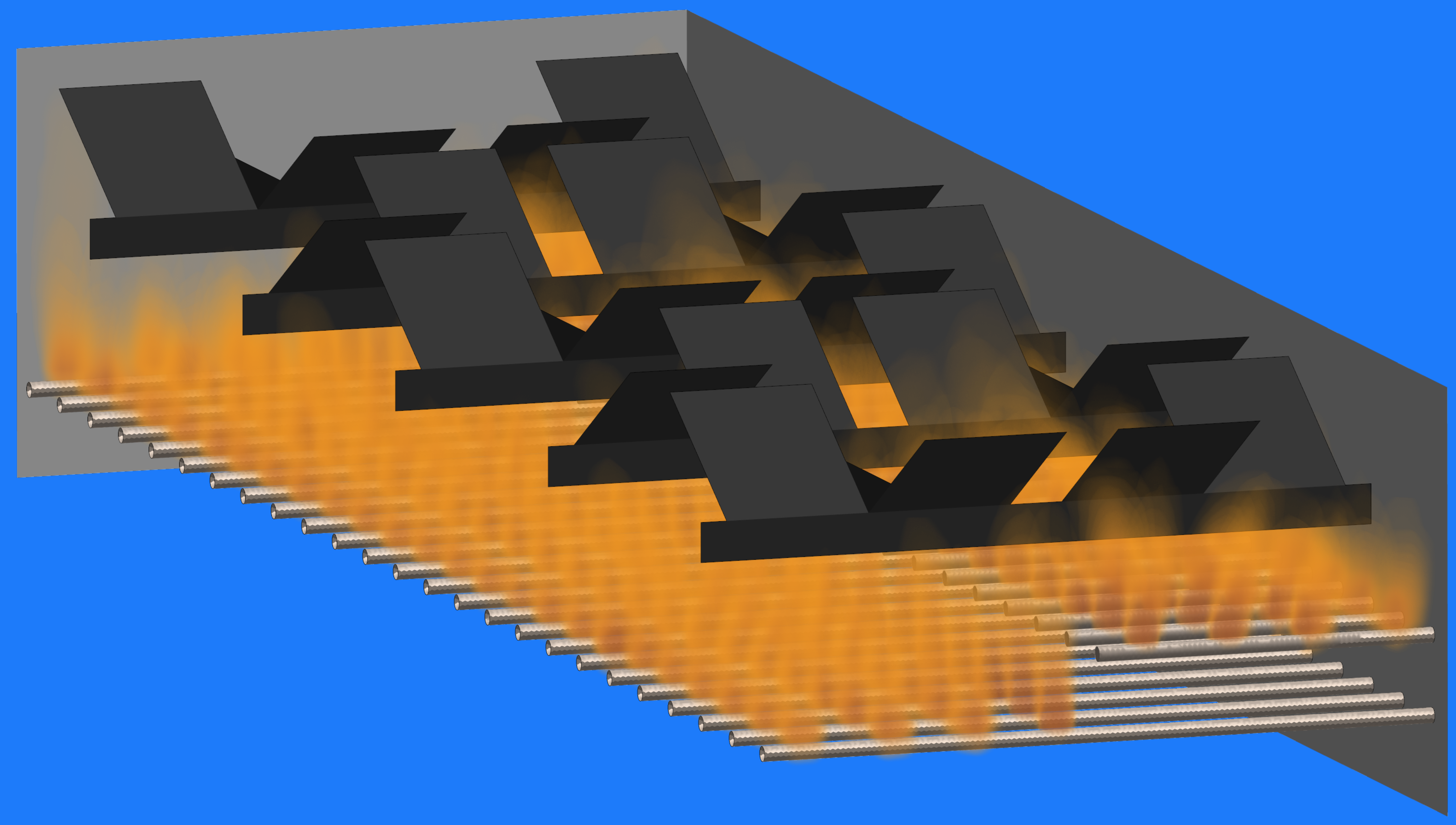
Manufacturing and installation simplicity

The typical flow optimisation process covers design, placement and selection of the minimum amount of conditioning devices needed to properly distribute the flow.

To do so, the baseline case is evaluated, and flow optimisation devices are designed accordingly, taking manufacturing and installation simplicity into account.

Injection systems are also optimised upon request, as well as the geometrical re-design or even initial design of flow ducts.



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Further information you can benefit from

- Emission reduction technologies using CFD (video)
- Flow laboratory testing facility
- Design and validation of efficient flue gas cleaning systems using CFD
- With CFD simulations Chinese coal-fired power plant now complies with NOx emission regulations (case)

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