Case Study

RENUDA
FLUID SOLUTIONS

Retrofit and erosion analysis for power generation: EDF R&D

The Background

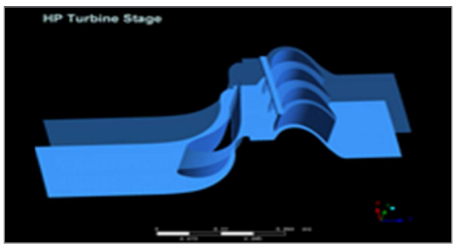
EDF is one of Europe's major electricity producers and its R&D group plays a key role for the Company. The R&D group's Fluid Dynamics, Power Generation and Environment Department is working with the design, construction and exploitation departments to solve issues related to the evolution of power stations or innovative processes for EDF worldwide.

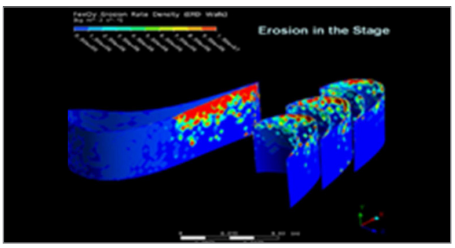
EDF's R&D department sometimes uses external resources. In the field of steam turbine flows, its selection criteria are stringent: consultants must fully understand turbomachinery, and have experience in running numerical simulations using "streamline curvature" software (such as EDF's in-house code "CAPTUR") or CFD software. EDF found that rare combination of skills and experience in Renuda. EDF commissioned its first project from Renuda in 2007; several successful projects later the companies continue to work together on a wide range of challenges.

"Renuda's clear understanding of turbomachinery flows is the key reason we keep using them. They're not a company that just does CFD calculations."

Jean-Marc Dorey

Research Engineer, EDF – EDF R&D



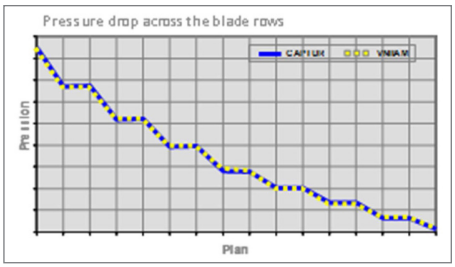


Challenge 1: Verification of a new steam turbine design

EDF commissioned a Russian institute to retrofit a steam turbine design in order to evaluate the potential for power increase. The institute produced results that predicted improved turbine efficiency and power capacity. EDF wanted these predictions independently verified and they wanted CAPTUR to be used in this verification process.

The Solution

- Renuda created a geometric model of the last four turbine stages. They then ran a series of simulations (using EDF's CAPTUR code) under various operating conditions. Renuda compared the results of these simulations with those provided by VNIIAM: there was a close match. Renuda validated the Institute's predictions.
- Renuda's work was conducted under an ISO 9001 based Quality Assurance process.



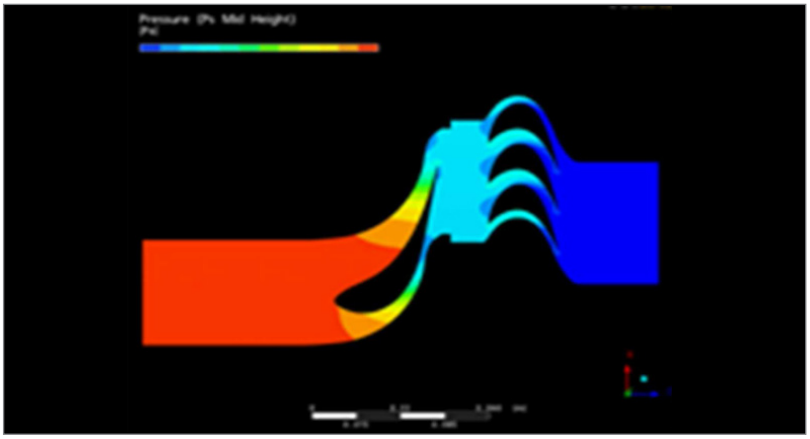
Challenge 2: Modelling erosion in a HP steam turbine

EDF experienced an erosion problem in the first stage of the HP steam turbine during the commissioning phase of a new combined cycle power plant (CCPP). They needed to resolve this issue quickly in order to avoid having future costly downtimes. They needed to find the acceptable particle threshold below which the likelihood of erosion would be minimal.

The Solution

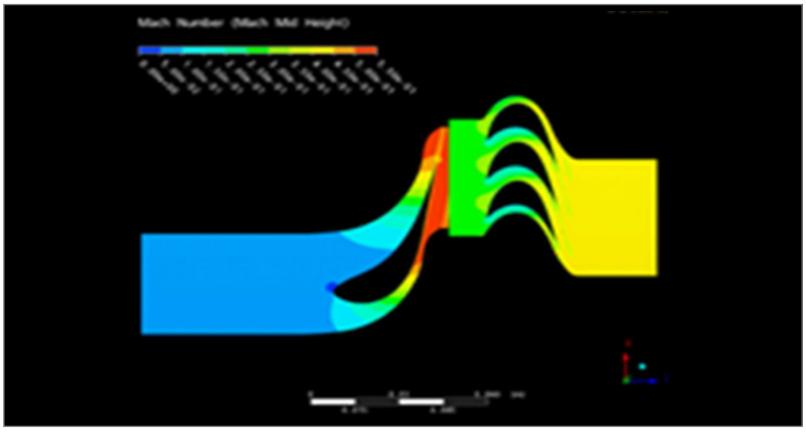
- Renuda used CAD to determine the geometric model of the first stage of the HP steam turbine. They then produced simulations using different parameters to calculate the flow of particles inside the steam turbine. This enabled them to see how the particles struck the blades, and analyse the particle trajectories and impact energy. As a result they were able to compare the level of erosion under different geometric and operating conditions.

- The results of the simulations enabled EDF to define the requirements for filters on the turbine inlet and provided a good insight into the preparations that would be necessary before starting new turbines i.e. everything inside the boilers upstream of the HP turbine will need to be washed and checked much more carefully.
- EDF will now use these conclusions from this study to define cleaning processes before starting new combined-cycle power plant.



How EDF Benefited

- EDF were reassured that the institute's new steam turbine design was validated.
- Renuda's erosion simulations enabled EDF to redefine the cleaning processes in its combined-cycle power stations. This will reduce the risk of delayed delivery of an operational CCPP avoiding a significant cost overrun for EDF.



Unexpected Benefits

- Renuda was so proficient with EDF's CAPTUR code that EDF now plan to use Renuda as the CAPTUR repository.
- Renuda will manage and maintain CAPTUR for use by various EDF departments, and potentially also for the benefit of other companies.

"We have engaged in a long term partnership: Renuda uses and develops CAPTUR, our software for the modelling of flow in steam turbines."

Michel Guivarch

Consultant, Steam Turbines,

EDF – DPN/UNIE

Why did EDF choose Renuda?

- Their specialist knowledge: Renuda's engineers understand Turbomachinery, so EDF did not waste time in educating them.
- Their software expertise: Renuda works with a variety of CFD software tools, from multi-purpose commercial software to open source solvers and in-house codes.
- They are unprejudiced: Renuda's engineers are open to debating alternative approaches, even after the project has commenced.

"I'd certainly recommend Renuda... but I'd rather keep them for myself!"

Jean-Marc Dorey

Research Engineer, EDF - EDF R&D

Contact Us

Renuda UK, France, Germany

+44 (0)20 3371 1709

Please visit our website www.renuda.com for more information or contact us on info@renuda.com