

# HPC acceleration of valve design for hydrogen and carbon capture

## The Brief

Oliver Hydrovalves is an industry-leading company that harnesses over forty years of technology, development and expertise in designing and manufacturing precision valves for hydrogen and carbon capture applications. Hydrovalves is committed to delivering valve solutions as part of the global ambition to reduce carbon emissions.

Moving towards carbon-neutral goals is becoming an essential part of the discussion within Oliver Hydrovalves, building on 40 years of technical experience, the company is now turning its expertise to hydrogen and carbon capture challenges.

The company manufacture and supplies high-performance pipeline ball valves for hydrogen transport. This is performed at high pressures so the strength of the ball that controls flow inside the valves needs to resist flexing, whilst ensuring a metal-to-metal seal is maintained. Due to the properties of hydrogen, high-pressure valve materials need to be resistant to hydrogen embrittlement to ensure a loss-less environment and long-lasting operation to prevent hydrogen escaping. Designing and testing materials and geometry needed for a leak-free valve is a time-consuming and costly process.

## The Approach

Software Engineers at the STFC Hartree<sup>®</sup> Centre worked with Oliver Hydrovalves to develop a Finite Element Analysis (FEA) solver to calculate the displacements and stresses within the valve. Existing computer-aided design (CAD) geometry was retracted directly from the company's engineering teams and used to generate accurate computer simulation meshes of the valves. These simulations were then run on the STFC Hartree<sup>®</sup> Centre's supercomputer, Scafell Pike, enabling faster solve times and detailed visual models of stress and displacement in the valve assembly. This visualisation identified likely points of failure for potential valve designs, providing valuable insight into the state of valves under pressure.

## The Benefits

The power of fast, high-quality simulations coupled with the FEA solver helped Oliver Hydcovalves test a variety of highly detailed operating parameters, generating a much wider set of results than what would be feasible with solely physical testing. This work will reduce the amount of prototyping and testing needed, reducing costs and optimising the process to help the company reach Net Zero targets. The validation of these results gave Oliver Hydcovalves confidence in the digital-first approach, allowing them to adopt simulation and modelling within their valve design processes.

*“Product design and value engineering have taken a massive leap forwards as a result of the partnership developed between Oliver Hydcovalves and the STFC Hartree® Centre.*”

*The STFC Hartree® Centre has allowed us to use specialist techniques to refine our designs to a level that otherwise would have been beyond our reach.”*

– Nick Howard, Oliver Hydcovalves

