Fatigue is one of the key degradation mechanisms affecting the integrity of important PWR components. However, metallic fatigue is also a challenge scientific phenomenon that crosses the boundaries of mechanics and materials science. There is a need to develop new mechanistic methodologies that can bring insight into fatigue crack growth and be used to predict the service life of high integrity PWR components.

The goal of this PhD project is to develop advanced computational tools for predicting fatigue crack growth and environmentally assisted fatigue. Phase field-based methods, machine learning and other approaches will be considered to capture the interplay between the loading history and the nucleation and growth of cracks. The student is expected to collaborate closely with a companion experimental PhD project.

The project will be conducted in close collaboration with EDF Energy, who own and operate the only operating nuclear power plants in the UK. This includes the Sizewell B Pressurised Water Reactor (PWR), which is looking to seek lifetime extension, from 2035 to at least 2055. EDF are also constructing EPRs at Hinkley Point C and potentially Sizewell C. In the UK PWR based Small Modular Reactors (SMRs) are also being considered. All of this is a crucial contribution to the UKs ambition of achieving net-zero carbon emissions by 2050.