

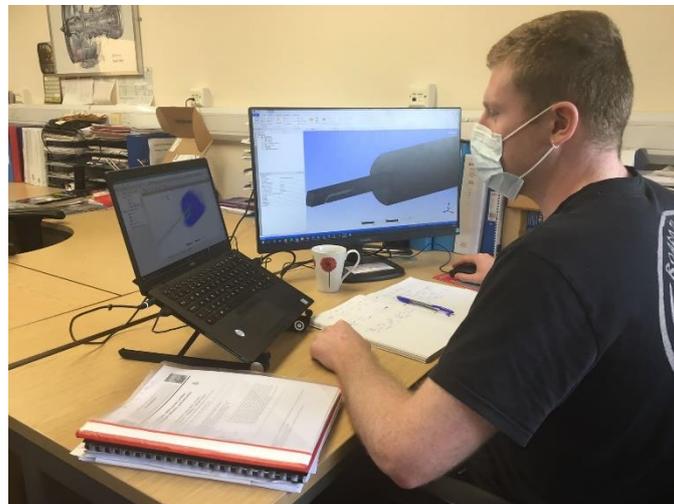
## **Bryan Marsh Gold Development Award Winner 2022**

### **James Bain.**

I would like to extend a very warm thank-you to the Worshipful Livery Company of Wales for not only bestowing their Bryan Marsh Gold Award & Engineering Travel Scholarship to me this year, but also for making these awards and many others available to young Welsh people like myself.



Currently, I am undertaking my PhD at Cardiff Universities School of Engineering, where I am researching the effects of introducing hydrogen into the fuel supply for Gas Turbine Power Stations, that in turn generates electricity. The aim of this is to decarbonise the Power Sector as a whole and mitigate the industry's contribution to climate change.



Renewable energy sources such as wind and solar are a terrific clean means of producing electricity, however, they do in turn introduce instabilities onto grid due to the temporal conditions of the weather that these sources rely upon. Gas Turbines are then used to not only provide power to the grid but also offer ancillary services to maintain stability on grid that the renewables can induce.

Traditionally, Gas Turbines are operated with carbonaceous fuels such as fuel-oil or natural gas, which produce CO<sub>2</sub> emissions, which has a well-documented Greenhouse Gas Effect upon our atmosphere. Hence, my research is focused on the conversion of the GT26 Gas Turbine (5 of which are operated at Pembroke Power Station, which has the capability to power twice the number of homes in Wales) to

operate on pure hydrogen and blends of natural gas and hydrogen. Since hydrogen is carbon independent, the fuel blends will produce a lesser intense CO<sub>2</sub> emission and the use of pure fuel will mitigate all CO<sub>2</sub> emissions from Gas Turbines. In essence, to decarbonise the power sector and to realise a higher penetration of renewables, it is necessary to decarbonise Gas Turbines.



The Bryan Marsh Gold Award monies will be used to contribute to the development of my experimental test rig, of which is of bespoke design. This will enable me to complete the full range of my intended test campaign, of which little work has been carried out in this particularly field of research that I am investigating within hydrogen fuel combustion. For this I am very grateful to the Livery in enabling me to carry out the full depth of research I had intended to undertake whilst devising my hypothesis, which I would not have been able to do due to budget constraints.

The monies for the Engineering Travel Scholarship are also being used to enable me to attend ASME's Turbo Exposition in Rotterdam this year, where I will be competing in the student poster competition. ASME's Turbo Expo is renowned for its expansive cross section between industry and academia across all aspects of turbomachinery technologies. Attending said conference will enable me to network extensively, attend technical sessions and garner connections and develop professional relationships.



I would like to conclude by again thanking the Livery for their continued support which has enabled me to realise depths of research which were previously unattainable, allowing me to produce more meaningful and advanced research outcomes. And I am deeply grateful for the ability to participate at ASME's Turbo Expo this year. Both of which will, and have had, a positive impact on my career as a decarbonised combustion research engineer.



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