Thermofluids research is the application of experimental and/or modelling techniques with the aim of understanding the interactions between thermodynamics, heat transfer and fluids. Thermofluids is the basis for many everyday technologies and physical phenomena and governs numerous activities where energy is converted, exchanged or changes form.

Through multi-disciplined areas of expertise for group members, our research interests include energy conversion systems, renewable energy, alternate fuels, fluidic behaviour as well as physical process modelling and optimisation. Our activities into fundamental and applied research are enabled through a range of state-of-the-art resources which enable multi-channel turbulence measurements in gaseous flows, digital imaging (high speed visible and infra-red), flow visualisations, image processing as well as combustion emissions analysis. Other resources also include solar-photovoltaic modules, hydrogen fuel cell systems, units for desalination and various sensor, data acquisition and control modules.

We encourage enquiries from students and researchers wishing to pursue research activities in our research group. We also welcome enquiries from industry seeking solutions or collaborations in relevant research areas through Research and Development.

**Thermofluids Research Group Research Themes**

- Hydrogen Technology, Alternate Energy and Energy Systems;
- Turbulent Jets;
- Combustion; and
- Experimental Techniques

For more information, visit: [www.ecu.edu.au/schools/engineering/research-activity/thermofluids-research-group](http://www.ecu.edu.au/schools/engineering/research-activity/thermofluids-research-group)
Research Themes

Hydrogen Technology, Alternate Energy and Energy Systems
Hydrogen is an energy carrier which can be integrated into stationary and mobile energy systems. Stationary applications include stand-alone systems based on renewable energy sources like solar or wind. In this instance hydrogen provides a means of (battery free) energy storage and can also be used later in fuel cells for power generation. Stand-alone energy systems, based on solar–photovoltaic technology, also form an important area of energy research with applications for remote communities. The optimal deployment of energy systems requires adequate understanding of the design and operational parameters affecting their performance. Through combining experiments with modelling a better understanding can emerge of energy systems.

Turbulent Jets
Research into flow behaviour allows for a better understanding into the fundamental and applied aspects of fluid dynamics. Fluids find widespread application in process industries as well as operations dependant on convective flow currents, whether aimed at cooling or heating. Investigations into steady state as well as time-varying (unsteady) jets flow help further our understanding of how different factors affect flow mixing and overall jet behaviour. This can be facilitated through a number of techniques applicable to both free and impinging turbulent jets, including flow visualisations and turbulence measurements.

Combustion
Despite continued efforts to develop the use of renewable energy sources and technology, reliance continues on combustion-based processes (using fossil fuels) to support many industrial as well as every day activities. These include stationary applications, such as power generation or heating processes, as well as mobile applications, like personal transport. Combustion research may also include studies into more sustainable means of power provision through fuel stocks derived from timber biomass. Much research is conducted world-wide into combustion to help develop and apply alternate fuels, increase process efficiencies and reduce emissions. Studies on combustion processes can also further understanding of relationship between operational, environmental and design factors on pollutant formation.

Experimental Techniques
Diagnostics and experimental techniques are an important pathway to help understand various thermo fluids related problems. Experimental techniques also provide an essential tool for the validation and development of computational models. These laboratory based methods can be based on a range of sensor as well as non-intrusive (optical) methods with widespread application to various disciplines, in engineering and beyond.

Research Projects
- A study into the performance of a fixed-bed biomass combustor operating on pellet fuels
- An experimental and numerical study of surface interactions in swirling jets
- An investigation of thermal effects in a fixed-bed biomass combustor
- Optimisation of renewable energy systems based on PV/wind/hydrogen using intelligent techniques
- Stand-alone energy systems meeting power and incorporating waste heat recovery
- Stand-alone solar–PV hydrogen energy systems incorporating Reverse Osmosis

Contact
If you are interested in applying to ECU and want to discuss a specific project proposal in thermo fluids, contact:

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