IChemE
YOUNG
ENGINEERS
AWARDS
for Innovation
and Sustainability

IChemE YEAIS Awards

UK Showcase and Celebration Event

16 June 2025

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Welcome

We are delighted to welcome you to the 2025 UK showcase and celebration event for the Young Engineers Awards for Innovation and Sustainability (YEAIS).

Recognising new and emerging talent is vital. The IChemE Young Engineers Awards for Innovation and Sustainability (YEAIS) celebrates the ideas and innovation emerging in the chemical engineering profession, as well as those innovative concepts from young individuals who could become our future chemical engineers, supporting IChemE's vision of engineering a more sustainable world.

We hope you enjoy today's showcase and take inspiration from hearing directly from the winners, highly commended participants, and others whose innovative ideas caught the judges' attention.

This in person event is one of six YEAIS showcase and celebration events with the remaining five showcases taking place virtually. As this is a UK showcase, this brochure features project summaries from all finalists and high scoring UK entries as well as top scoring UK school entries. As this is a pilot year, we hope to be able to hold more in person showcase and celebration events across the globe in subsequent years.

In 2025, the YEAIS Awards focus on key themes that reflect IChemE's strategic priorities. These themes align closely with the UN Sustainable Development Goals (SDGs) that most depend on the expertise of chemical engineers. The first four topics directly correspond to eight targeted SDGs, while the final three represent essential foundational areas and cross-disciplinary themes critical to achieving the SDGs.

This year's focus areas include:

- Clean Energy and Climate Action
- Water and Sanitation
- Food, Health and Well-being
- Responsible Production, Innovation and Industry
- Quality Education, including Lifelong Learning
- Process Safety and Learning Outcomes from Major Incidents
- Digitalisation, including Cybersecurity

We're excited to connect with passionate young engineers, early-career professionals, and seasoned experts who are driving innovation and shaping the future of chemical engineering through collaboration and shared knowledge.

Whether you're here to present your work, make new connections, or expand your understanding, we hope the YEAIS showcase offers an enriching and motivating experience. Thank you for being part of this important event and for your valuable contributions.

Agenda

9:30 – 10:15	Poster set up
10:15 onwards	Guests arrive to view posters and network
11:00 – 12:30	Presentations and Q&A (Wellcome Trust Lecture Hall)
12:30 – 14:30	Networking buffet lunch
14:30 – 15:00	Award ceremony
15:00 – 15:30	Photographs
16:00	Close

Project summaries

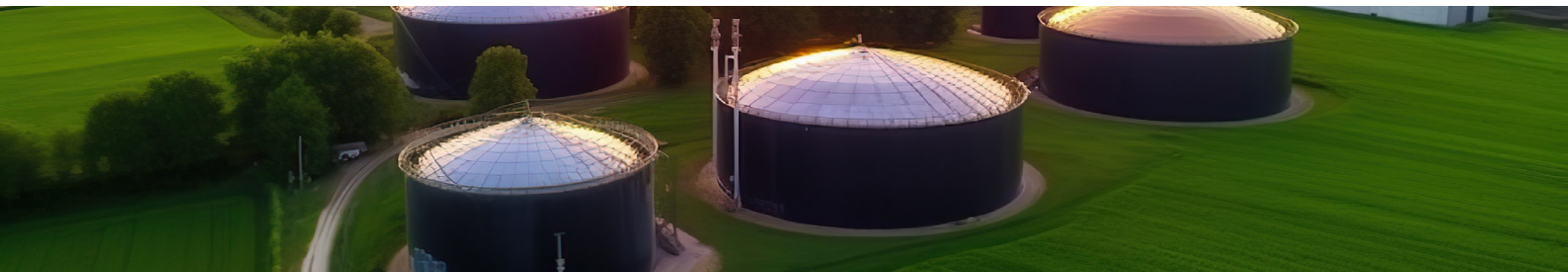
Clean energy and climate action

Poster display area – see floor plan	Project Summaries	Country
1	**Where next for the hydrogen rainbow?** **Olaoluwasubomi Abiodun and Mohamed Ali Fareed (Finalist)** University of Surrey As climate change accelerates, clean hydrogen is vital for decarbonising industry and energy systems. Green hydrogen, produced via electrolysis using renewable power, is widely regarded as the most sustainable option. However, recent discoveries of naturally occurring underground hydrogen – known as gold or white hydrogen – have introduced a potential low-cost alternative. This project evaluates the technical and economic feasibility of both green and gold hydrogen production, comparing their suitability for supplying industrial hydrogen to Whyalla, South Australia. The goal is to assess whether natural hydrogen can compete with green hydrogen as a scalable, sustainable solution for achieving net-zero emissions.	
1	**Molecular simulation and modelling of metal-organic frameworks for hydrogen storage performance** **Shim Hui Bin (Finalist)** Universiti Teknologi PETRONAS (UTP) Hydrogen storage is crucial for clean energy transition, yet conventional methods face challenges in cost, safety, and efficiency. Metal-Organic Frameworks (MOFs) offer a promising alternative due to their high surface area and tuneable porosity. This study employs molecular simulation to evaluate hydrogen adsorption behaviour in NU-1501-Al, NU-1501-Fe, PCN-610, NPF-200, and NOTT-112. Design Expert (DE) is then used to develop and validate an empirical model for optimising adsorption. The study aims to establish a robust computational framework for high-density hydrogen storage applications and develop an empirical model for process quantification.	
2	**Production of green hydrogen via solar powered electrolyser modules and atmospheric water generation** **Claudia Cavallo and Caitlin Grant (Finalist)** Worley Consulting Green hydrogen is a net-zero energy carrier produced via electrolysis of water using renewable energy. Three major barriers exist: 1. Power – intermittent and fluctuating renewable energy impacts stable hydrogen production. 2. Water – electrolysis requires ~9 L water/kg H2, preferably locally sourced to reduce costs. 3. Cost – large scale green hydrogen projects are commercially immature as electrolyser, balance of plant, and power and water infrastructure costs remain high. With the goal of reducing production costs by 2030, this project proposes using solar-powered green hydrogen modules and atmospheric water generators (AWGs) to eliminate the requirement of large volumes of locally sourced water.	

1	**AI enhanced life cycle sustainability assessment of green ammonia technologies** **Thorin Daniel** University of Surrey Assessing green technologies often results in an uneven comparison, due to the non-uniform level of technological development and overt focus on single issue indicators such as cost. Here, we develop a life cycle sustainability assessment framework and integrate learning curve analysis to allow a fair and complete comparison of green ammonia technologies as they mature. A custom large language model retrieval augmented generation pipeline is developed to rapidly generate high quality data from a corpus of papers to enhance the social life cycle assessment.	
1	**Process synthesis and performance analysis of low carbon heat-driven direct air capture** **Ikuni Ebereonwu (Finalist)** University of Birmingham and Arup Direct Air Capture (DAC) is a critical technology for capturing widespread anthropogenic CO2 emissions from hard-to-decarbonise sectors such as transport. A major challenge lies in the high operational costs, driven by the energy-intensive fans used to process large air volumes required for effective CO2 removal. The reliance on electricity creates significant economic barriers. This project proposes an innovative solution: utilising a solar chimney configuration and buoyancy-driven airflow to replace traditional fans. By harnessing passive energy sources, this approach aims to reduce energy consumption and operational costs, offering a more efficient and sustainable pathway for scaling up DAC technologies.	
1	**DECO2: decarbonation options optimisation (an opens-source software supporting decarbonisation journeys of emerging economies)** **Gul Hameed** University of Surrey Emerging nations face a growing carbon footprint due to rapid industrialisation and economic growth primarily driven by fossil fuels. These countries are highly vulnerable to climate change, experiencing severe economic and societal impacts. Therefore, a transition to low-carbon economy is crucial. To support this, DECO2 has been developed and modified to aid regional and national power sectors by: integrating renewable energy into the grid, deploying negative emission technologies, and implementing economic instruments like carbon trading. The tool is designed to assist stakeholders in proposing evidence-based pathways/ frameworks to achieve net-zero power grids.	
1	**Next-gen carbon capture: the ionic liquid and hollow fibre breakthrough** **Adeline Hannon** University of Edinburgh What is the problem? Problem 1: carbon capture with amines solvent regeneration uses high energy consumption, unfavourable conditions, and is cost inefficient (~140 C, 4.0 GJ/t-CO2). Amines are very volatile and corrosive. Problem 2: ionic liquids and low surface area due to the nature of ionic liquids, they have a non-ideal surface area to volume ratio for absorption reactions. Carbon capture is necessary to reduce emissions and achieve climate goals on a global scale. Developing a process operating at standard pressure and temperature with low energy solvent regeneration, results in a more optimal process. Carbon capture can become more accessible, cost effective, and energy efficient.	

Clean energy and climate action

Poster display area – see floor plan	Project Summaries	Country
3	**Development of a novel cross-current configuration for enhanced syngas production from biomass** **Anuj Joshi and Rushikesh Joshi (Finalist)** The Dow Chemical Company The increased environmental stress due to rising demand for energy and chemicals has necessitated the development of carbon-neutral technologies. Biomass, a low-carbon feedstock, is a promising alternative to fossil fuels, and the chemical looping platform can be leveraged to establish a process for biomass gasification to syngas, a key building block for chemicals. The chemical looping platform utilises solid oxygen carriers (OC) in a two-step configuration, with advantages such as product separation and operational flexibility. The Ohio State University has licensed a chemical looping technology for biomass gasification. However, this project is part of the effort to further improve the technology.	
1	**Bi-metallic catalyst development for methane hydroaromatisation** **Amal Sasi Kumar** Bostik Ltd This project proposed a novel strategy to synthesise zeolite catalysts with certain activity, achieved by Zn, Mo and Ag metal loading which act as promoters. Objective: synthesise by means of wetness impregnation and characterisation of the samples. Synthesise by means of ion exchange and characterisation of the samples. Comparing the characterisation results of the two methods and analysing it.	
1	**Sorption enhanced steam methane reforming coupled with chemical looping: novel technology for high purity hydrogen production with low energy demand and carbon footprint** **Dr. Theodoros Papalas (Finalist)** University of Cambridge ■ H2 is a major industrial gas and promising energy vector, but the conventional steam reforming of natural gas synthesis is characterised by high CO2 emissions and energy demand. ■ introducing a CaO-based sorbent enables in situ CO2 removal and high-purity H2 production in a single autothermal stage at a milder reforming temperature of 650°C. However, the formed CaCO3 must be regenerated in a second reactor. ■ energy demand of endothermic regeneration can be supplied by the exothermic oxidation of a suitable oxygen carrier (OC). ■ objective: investigate Ni-Co OCs to experimentally prove the SE-CL-SMR concept and unravel the effect Co addition.	



2	**HYDECO: co-generation of drinkable water and cold storage with low-grade heat sources** **Gayatri Sundar Rajan (Finalist)** University of Oxford Picture a world with sustainable, affordable, and decentralised water and cooling production. Who: low-income farmers suffer from water-scarcity and loss of harvested produce due to lack of available cold-chain infrastructure. Scope: more broadly, ■ 1/3 of the population experiences water and food scarcity and ■ >17% of harvested produce – fruits and vegetables – in developing economies is wasted due to inadequate refrigeration. Context: developing economies are most severely impacted because of the limitations of existing water and cooling infrastructure. Potential: to enable widespread water and cooling access, new approaches need to be: low capital cost, independent of existing electrical infrastructure, and simple to maintain.	
1	**Controllable material and sustainable synergistic process for carbon capture, utilisation and waste heat recovery** **Zirui Wang (Finalist)** University of Oxford 70% of the UK industrial energy demand is for heat. The steel and chemical sectors can waste up to 50% of the heat used. Eg British Steel release a large volume of CO2 (20.64 t/hr) and waste heat (121MW). High requirement to develop novel approaches to address key differences between sectors, such as steel and chemical industries.	
2	**Powering Sabah (Malaysia) with palm waste: a green energy revolution** **Fei Heah Xiang (Finalist)** University of Birmingham To provide secure, sustainable, and affordable energy for Sabah, addressing the urgent needs of over 400 villages (120,000+) people without electricity. As Malaysia's second-largest state, Sabah relies heavily on natural gas (81% of electricity), with only 19% from renewables and a mere 2% from solar and wind. With 90% of palm oil waste underutilised, this project transforms it into clean energy, reducing fossil fuel dependence and bridging the energy gap. By 2025, Sabah's electricity demand will reach 1064MW, exacerbating shortages. Our solution empowers rural communities, ensuring a sustainable and energy-secure future.	

Water and sanitation

Poster display area – see floor plan	Project Summaries	Country
2	**Electrospun nanofiber-supported thin-film composite membrane: a breakthrough in seawater desalination** **Anniza Cornelia Augusty (Finalist)** RMIT University Thin-film composite (TFC) membranes are widely utilised in nanofiltration (NF) and reverse osmosis (RO) for desalination and water purification. Enhancing water permeability of NF/RO membranes is essential for reducing energy consumption while maximising freshwater production. The formation of the polyamide (PA) thin film is significantly influenced by the characteristics of the support layer. To achieve higher water permeability, electrospinning is employed to fabricate the support layer, as it produces highly porous nanofibers with an interconnected pore structure and tunable properties, outperforming conventional phase inversion methods. Additionally, post-treatment is applied to improve support hydrophilicity and strengthen the PA-support interface.	
1	**An activated steel scale waste catalyst to degrade methylene blue via the heterogeneous fenton process** **Domenica Paulina Seminario Calle** University of Cuenca This study explores using Steel Scale Waste (SSW), an iron-rich industrial byproduct, as a low-cost heterogeneous Fenton catalyst to remove Methylene Blue (MB) from wastewater. Traditional methods are inefficient, and homogeneous Fenton processes produce iron sludge. By optimising catalyst dosage, hydrogen peroxide concentration, and light exposure, this research enhances MB degradation while promoting a circular economy by repurposing industrial waste for sustainable water treatment.	
3	**Sustainable wastewater treatment for rural communities: implementing vegetated ditches and trickling filters** **Chong Wei Hao, Muhammad Syukri Afifi, Shakimi Haikal and Nur Rifhany Meliss (Finalist)** Universiti Teknologi PETRONAS (UTP) Rural communities like Kampung Bario in Sarawak lack proper wastewater treatment infrastructure, leading to river pollution, health risks, and environmental damage. Untreated greywater and blackwater contribute to high levels of BOD, ammoniacal nitrogen (NH_3-N), and E. coli, failing to meet Class II water standards. This project proposes a low-cost, modular wastewater treatment system using vegetated ditches and trickling filters to ensure cleaner discharge, ecosystem protection, and improved public health.	
1	**Solar-powered filtration; improving the quality of life and reducing poverty** **Zuleikha Hussain (Finalist)** The University of Sheffield More than 2.2 billion people globally lack access to safely managed drinking water due to parasites and debris. Many marginalised groups experience the blunt of this, including women and children. With limited resources in many deprived areas, how can we utilise solar energy to sanitise water and improve the quality of life of millions in warm regions?	

1	**Per- and polyfluoroalkyl substances (PFAS) in wastewater sludge and biosolids** **Usman Muhammad Ismail** Swansea University ■ per- and polyfluoroalkyl substances (PFAS); a group of widely used synthetic organofluorine chemicals with interesting properties. They are also called forever chemicals. ■ unfortunately, they have shown toxic traits to human and are harmful to the environment. ■ land application of biosolids is a potential route for PFAS into the environment. ■ around 3.76 million metric tonnes d.w. of processed sludge (biosolids) is land applied annually in the UK.	
2	**Efficient graphene/silica-functionalised melamine foam for rapid adsorption of diesel oil from water** **Darren Lim Ming Qian and Aishah Sabarudin (Finalist)** Heriot-Watt University Malaysia Diesel oil pollution – more than 38,000 tonnes of oil is spilled globally from sources including marine vessels, leaks from tanks and pipeline ruptures. Diesel is highly toxic to wildlife and can severely degrade water quality. The annual cleanup cost is more than $30 billion. Solution: graphene/silica functionalised foam (GSF) ■ improved hydrophobicity for enhanced oil uptake. ■ high flexibility and high surface area. The benefits include rapid and efficient method for diesel cleanup, novel and regenerable, material for industrial application and a floatable adsorbent for easy recovery and efficient regeneration.	
1	**Wem: implementing innovative low footprint wastewater treatment for small communities** **William Ryden (Finalist)** Mott MacDonald Bentley – MMB To futureproof Wem's sewage treatment works for 2038, a new facility was required to handle double the flowrate, increasing from 38l/s to 64l/s, while meeting stricter effluent quality consents for ferric (0.6 mg/l) and iron (4 mg/l) by December 2024. The innovative Oxibox process unit, effectively a reduced footprint activated sludge plant, was a new technology. The implementation required a novel control philosophy, process design, and commissioning, all successfully carried out by MMB on behalf of STW, to improve river quality and future proof the community.	
2	**Using metagenomics to improve wastewater treatment** **Sam Sarrafi and Rowan French (Finalist)** United Utilities Wastewater treatment relies on bacteria in secondary treatment to decompose organic pollutants. There is minimal understanding within the water industry of the 'biological infrastructure' that drives this process. On the behalf of United Utilities (UU) we are working in collaboration with Newcastle University, to explore Metagenomics as a pioneering solution. By sequencing microbial DNA, we can accurately identify the makeup of bacteria in wastewater treatment works. This innovation would allow operators to monitor microbial health, improve plant performance, provide early warning signs and help us to understand process emissions (specifically N2O), which are accelerating climate change.	

Food, health and well-being

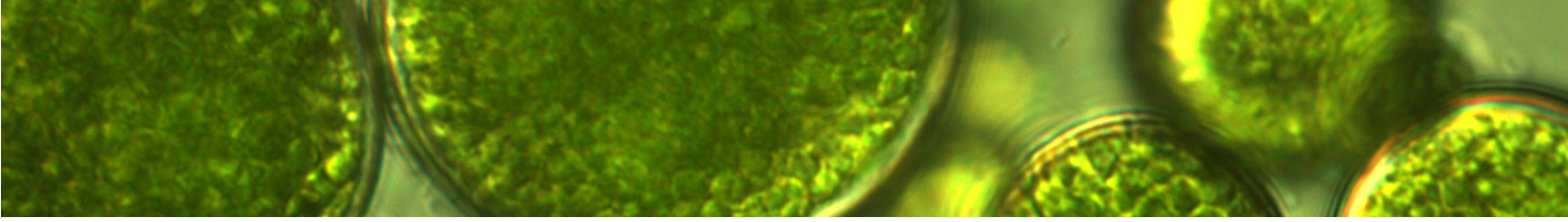
Poster display area – see floor plan	Project Summaries	Country
1	**EcoMed: powering healthcare, protecting lives** **Ani Ahmed, Eylul Akgok, Daniel Bull, Helen Lee and Tony Na (Finalist)** Imperial College London EcoMed tackles the urgent challenge of vaccine storage and transport in off-grid, resource-limited regions like Kano, Nigeria. Many vaccines, including RTS-S for malaria, require strict temperature control (2-8°C), but unreliable electricity and poor cold chain infrastructure lead to high vaccine wastage. EcoMed is a solar-powered, thermoelectric refrigerator with PCM (paraffin phase change material), designed to provide stable, energy-efficient cooling without harmful refrigerants. By combining renewable energy, thermoelectric cooling, and thermal energy storage, EcoMed ensures sustainable, low-maintenance vaccine storage, reducing reliance on diesel generators and improving last-mile vaccine delivery.	
1	**Engineering biomimetic materials for synthetic antibody sensors in cardiovascular diagnostics** **Dr. Joshua Saczek (Finalist)** University of Manchester Within the UK, around 7.6 million people live with cardiovascular diseases (CVDs), responsible for 25% of all deaths and costing £9 billion annually. Heart attacks (HAs) are a common CVD, characterised by heart tissue damage. Troponin I (cTnI), a cardiac biomarker, is released into the blood during HAs and can indicate this damage. Molecularly imprinted polymer nanoparticles (nanoMIPs) are synthetic antibodies that rival the affinity of their natural counterparts. Unlike biobased receptors, they are: ■ highly versatile, adaptable to detect almost any target. ■ extremely stable, do not require temperature-controlled storage and show extended shelf life. ■ animal free technology.	

Responsible production, innovation and industry

Poster display area – see floor plan	Project Summaries	Country
1	**Engineering a circular water strategy: repurposing industrial water for sustainable oil production** **Ahmad Almousa (Finalist)** Saudi Aramco Solving freshwater scarcity through industrial water reuse water scarcity is a pressing challenge in arid regions, particularly for industrial operations that heavily depend on fresh water. In my gas processing facility, significant volumes of industrial water were being disposed of inefficiently, wasting valuable resources. Specifically, I identified three industrial water streams that were previously discarded: 1. Reverse Osmosis (RO) 2nd pass reject water. 2. Cogeneration Blowdown part of a steam generation process. 3. Boiler Blowdown part of steam generation process. These industrial water streams were being disposed of at evaporation ponds, leading to excessive water wastage. I recognised an opportunity to optimise water usage by repurposing these industrial water streams rather than disposing of them.	
1	**Comparative design study of single-use vs stainless steel equipment in pharmaceutical facility engineering** **Mohammad Ammar (Finalist)** PM Group Single-use bioprocessing equipment has gained popularity in pharmaceutical facility design due to its manufacturing flexibility and elimination of cleaning requirements. Conversely, stainless-steel equipment requires extensive cleaning and sterilisation, leading to an ongoing debate within the industry. What is more sustainable, the repeated use of plastic, or the high energy consumption of clean utilities? This study aims to perform a comparative lifecycle assessment of complete facility designs using stainless steel and single-use equipment at varying annual throughputs. It will evaluate embedded carbon during commissioning, operation, and decommissioning to offer a comprehensive sustainability evaluation.	
1	**Synthesis and applications of Zn-MOFs for efficient carbon capture via sustainable processes** **Jessica Ansell and Dihini Gunarathna** University of Wolverhampton This research contributes to developing advanced porous materials that can be applied to large-scale carbon capture technologies. By optimising thermal stability and porosity, these materials could efficiently trap CO2 emissions from major industrial sources such as aviation, shipping, and power plants. Integrating such materials into emission control systems can significantly reduce greenhouse gas output, supporting global efforts to combat climate change. With further development, this work moves us closer to scalable, sustainable solutions for achieving net zero emissions and promoting cleaner industry practices across sectors with high environmental impact.	

Responsible production, innovation and industry

Poster display area – see floor plan	Project Summaries	Country
2	**Decarbonising the skies: sustainable aviation fuel from waste cooking oil via HEFA-SPK** **Chuah Yi Chen, Grayson Pan Kee Hao and Shaanan Kokiladasan (Finalist)** Universiti Teknologi PETRONAS (UTP) Utilising waste cooking oil (WCO) to produce sustainable aviation fuel (SAF) contributes to solving waste minimisation and aviation industry decarbonisation. WCO-based SAF produce lifecycle emissions between 15.2 and 19.3 gCO2e/MJ compared to 88.7 gCO2e/MJ of traditional jet fuels; an average reduction of 80%. Additionally, the high GHG savings, non-interference with the food and land supply, and increased urbanisation make WCO the most attractive feedstock. In Malaysia, the 47% SAF blend mandate for all flights by 2050 outlined in the National Energy Transition Roadmap, policies incentivising WCO collection, and corporate collaboration makes the development of a Malaysian WCO-based SAF biorefinery feasible.	
2	**A waste-to-health and wealth (W2HW) approach: tuning multifunctional and sustainable colloids (eutectogel and oleogel)** **Zhi Ling Chew (Finalist)** Xiamen University Malaysia The objectives of this study were to: ■ assess the process-structure-properties relationship of durian seed gum (DSG) for eutectogel formulation. ■ to synthesise eutectogel with desired properties and stability using tunable sugarbased NADES and DSG. ■ to optimise the extraction of phytonutrients from fresh OPL using NADES. ■ to investigate the stability of nutrients in DSG, NADES, and eutectogel. ■ to evaluate the food coating and preservation performances of eutectogel and fortified eutectogel containing OPL extract. ■ to develop oleogel using durian seed and BSFL oil for use as fat replacer.	
2	**Creating a greener future for ironmaking** **Ming Jiang Gan (Finalist)** UNSW Sydney The iron and steel industry is one of the most energy- and emission-intensive sectors, contributing approximately 7% of global CO2 emissions. To meet climate targets, a 60% reduction in the sector's emission intensity is required by 2050, but rising global steel demand presents a significant challenge. The blast furnace route is responsible for about 70% of global steel production and accounts for about 90% of carbon emissions in the entire steelmaking route. As projections indicate its continued dominance through 2050, decarbonising blast furnace operations is crucial while emerging low-carbon technologies mature for wider adoption.	



1	**Mycelium-algae bio-composite packaging** **Tan Hui Hui and Lok Yi Hang (Finalist)** University of Cambridge Mycelium-algae bio composite as alternative packaging materials for polyurethane (PU) and expandable polystyrene (EPS). PU and EPS are widely used for packaging fragile goods due to their lightweight, durability, and shock-absorbing properties. However, their non-biodegradable nature, lack of recycling infrastructure, and reliance on a linear economy contribute significantly to environmental pollution, posing risks to biodiversity. In 2022, global demand reached 33 million tonnes, yet recycling rates remained below 14%. A sustainable alternative is mycelium-based bio-composites, which are biodegradable and eco-friendly. Reinforcing them with algae enhances water repellence, making them a viable replacement for conventional short-lifespan packaging materials and promoting a shift toward a circular economy.	
2	**Silver nanoparticles production using microalgae extracts** **Kelly Lai Yan Kei (Finalist)** Universiti Teknologi PETRONAS (UTP) Silver nanoparticles (AgNPs) are valued for their antimicrobial, catalytic, and optical properties. The AgNP market is projected to grow at a CAGR of 17.6%, reaching USD 332 billion by 2032 (Fortune Business Insights, 2024). However, conventional synthesis involves hazardous chemicals and high energy use which poses environmental concerns. This study explores a green synthesis approach using Spirulina platensis and Chlorella vulgaris extracts as bio-reducing agents. The key parameters like incubation time, extract-to-$AgNO_3$ ratio, and pH were optimised. Characterisation was conducted using UV-Vis, PSA, FE-SEM, and TEM, demonstrating the potential of microalgae for sustainable AgNP production.	
1	**pH-driven biosynthesis of silver nanoparticle colloids from garcinia mangostana L. (mangosteen) rind extract** **Min Kaung Htet Ko Ko (Finalist)** UCSI University Two-thirds of the mangosteen fruit is still disposed as solid waste when it contains valuable polyphenols such as anthocyanins and flavonoids. This study aimed to valorise mangosteen rind for the biosynthesis of silver nanoparticle (AgNP) colloids with pH as the driving force. This study also elucidated the yield and stability of bio-silver which are underreported in literature. The bio-silver can be potentially applied in antibacterial ultrafiltration systems for the food and beverage industry in future.	
3	**Urine to algae for nutrients in a circular economy: screening microalgal species for growth in diluted urine** **Harrison Lowe (Finalist)** University of Melbourne/Worley Microalgae offer a potential solution to a significant global challenge: the sustainable management and recycling of nitrogen and phosphorous nutrients from human waste. This research project aimed to recover essential nutrients from human waste as a value-added product. The research screened three novel species for growth in dilute hydrolysed urine, comparing them to the well-studied chlorella vulgaris: ■ chlamydomonas ■ haematococcus pluvialis ■ monoraphidium brownii	

Responsible production, innovation and industry

Poster display area – see floor plan	Project Summaries	Country
1	**Solar integrated anaerobic digester and aerobic composter (SIDAC)** **M.Devendran Manogaran (Finalist)** Universiti Teknologi PETRONAS (UTP) ■ improper organic waste management remains a pressing issue with significant societal and environmental impacts, especially when disposed of in landfills. ■ organic waste is rich in nutrients and can cause anthropogenic emissions while harbouring harmful pathogens, making proper treatment essential to prevent pollution and biohazards. ■ anaerobic digestion and aerobic composting are effective circular economy strategies for managing biomass waste. The challenge lies in integrating both methods into a singular, functional unit. ■ SIDAC addresses this gap by offering a scalable solution through serial connections, making it suitable for integration into waste management facilities handling organic waste.	
3	**Polyol ester emollient for personal care: natural, eco-friendly solutions for a greener future** **Ahmad Ameer Bin Mohamad (Finalist)** Petroliam Nasional Berhad Our mission is to develop natural and eco-friendly polyol ester emollients for personal care applications, focusing on the following key goals: ■ safe and skin-friendly formulation – produce emollients of various grades that are non-mutagenic, non-irritant, and non-sensitising to both skin and eyes, ensuring their suitability for personal care applications. ■ superior emollient performance – develop emollients with excellent functional attributes, such as optimal spreadability, smooth consistency, and hypoallergenic properties, to enhance user experience and product efficacy. ■ sustainability and environmental responsibility – align with PETRONAS' MFT 50.30.0 initiative by transitioning from fossil-based to sustainable, environmentally friendly emollients, contributing to a greener and more responsible personal care industry.	
1	**Effect of pH on pinacol rearrangement in subcritical water** **Daniel Reidy** Aston University In recent years, subcritical water has rose to prominence to replace harmful solvents. Subcritical water has many desirable properties, it is environmentally friendly, and it is inexpensive compared to typically used organic/inorganic solvents. However, the most fascinating property of subcritical water is that its properties changes under different conditions of temperature and pressure. As you can see in the figures in the top right, as you change the temperature to the subcritical region (approx. 100 – 374 oC) its ionic product increases to roughly three times what it is under ambient conditions, and therefore it can be used to promote acid catalysed reactions [1]. In addition to this, its dielectric constant dramatically decreases, this means many organic compounds become soluble in water which they typically wouldn't be under ambient conditions, and this minimises contact problems between phases. However, the reaction kinetics when using subcritical water is still poorly understood. For my research I aimed to discover the effect that pH has on pinacol rearrangement in subcritical water.	

3	**From waste to wings: closed-loop drop-in fuel production via an integrated thermo-catalytic process** **Abhisek Sahoo (Finalist)** Indian Institute of Technology Delhi Waste, often seen as an environmental burden, holds immense potential as a resource. With sustainability in focus, waste valorisation tackles both ecological and energy challenges. This research examines converting biomass and waste into drop-in biofuels via an integrated thermo-catalytic process. This circular approach transforms waste into a treasure for future energy solutions. By 2050, global waste could hit 3.4 billion tonnes yearly, straining economies and ecosystems. Yet, waste biomass – from agricultural scraps to municipal refuse – offers a carbon-neutral feedstock. Unlike landfilling or incineration, closed-loop technologies create high-value fuels, cutting pollution and fossil fuel reliance, decarbonising sectors like aviation and shipping.	
1	**Innovation with integrity: demining strategies through thermite-based technologies for responsible land remediation** **Zoha Tariq (Finalist)** Marte Technologies (Tecnologias Marte) Over 110 million active landmines and unexploded ordnance (UXO) threaten 60 million lives, destabilise ecosystems and renders land unusable for agriculture, housing, and industry, thus obstructing post-conflict recovery. Conventional demining methods risk personnel safety, generate toxic residues, and lack precision. Hence, to facilitate the objective of a sustainable, efficient yet cost-effective solution for deactivating landmines, thermite lances that make use of thermite reactions with calcium sulphate are developed. The exothermic reaction achieves temperatures >2500°C, penetrating rusted casings without explosives. Optimised for safety and cost, this innovation minimises environmental harm, avoids nitrogen oxide emissions, and uses Calcium Sulphate (an industrial byproduct). Aligned with UN's Sustainable Development Initiatives, the technology restores land for agriculture and infrastructure, advancing peacebuilding in conflict-affected regions.	
1	**Hydrogen recovery and optimisation for emission reduction (HEROiC)** **Karthigesan Velautham (Finalist)** Malaysian Refining Company Sdn Bhd Flaring plays a vital role in refinery safety by burning off excess gases. However, excessive flaring from unoptimised processes raises environmental concerns, particularly by increasing greenhouse gas (GHG) emissions. In our refinery, hydrogen and off-gas are the primary contributors to continuous flaring. Managing refinery hydrogen production and consumption is a significant challenge due to highly dynamic operations. The situation is further complicated by a complex hydrogen and fuel gas network involving multiple process units, each operated independently by different group of operators. This lack of coordination leads to inefficient operations, economic losses, and increased GHG emissions, motivated my interest to connect the dots by using my current role as APC engineer.	

Quality education, including lifelong learning

Poster display area – see floor plan	Project Summaries	Country
2	**A novel approach to chemical engineering work experience: by young engineers, for young engineers** **Joseph Carter, Benjamin Hilton, Lara Hill and Alana Prior (Finalist)** Sellafield Ltd. Our aim is to inform, inspire and influence the next generation of engineers through a novel, engaging and accessible work experience programme, led by early careers. Chemical Engineering is not a 'school-taught' subject and isn't as accessible as other STEM areas. We are striving to fill essential skill gaps in chemical engineering: ■ vacancies for roles in the UK have increased by 55% over the last 5 years; ■ current projections show an annual shortfall of engineers of up to 59,000.	
1	**Use of personal knowledge management tools to consolidate chemical engineering knowledge and teaching** **Lewis Phillips** University of Strathclyde Enhancing knowledge retention in chemical engineering education: chemical engineering students often struggle with fragmented knowledge, making it difficult to connect core concepts across disciplines like thermodynamics, reaction engineering, and process control. Traditional note-taking methods fail to support long-term retention and interdisciplinary learning. This research explores whether graph-based personal knowledge management (PKM) tools, such as obsidian, can enhance knowledge synthesis, retrieval, and application. By integrating AI-powered features and structured note-taking methods, this study aims to improve students' ability to retain and apply engineering principles, potentially transforming how chemical engineering knowledge is structured and shared in both academia and industry.	

Digitalisation, including cybersecurity

Poster display area – see floor plan	Project Summaries	Country
1	**Development of sustainable aviation fuel (SAF) greenfield plant digital twin for operator training purpose** **Henry Susilo (Finalist)** Honeywell Greenfield plant operators might be difficult to gain competency on plant operation, at least to train their first plant startup. ■ Sustainable Aviation Fuel (SAF) process is still considered new, especially in Southeast Asia, which increase the difficulty to train operator. ■ if there is a way to substitute the process plant and control system to digital independent platform where operator can train freely, it will be very beneficial. ■ technology → Operator Training Simulator (OTS): process plant simulation + emulated control system + DCS HMI.	
1	**Enhancing oilfield efficiency with interactive maps and pressure simulations** **Abigail Clarke (Finalist)** Shell Trinidad and Tobago This project was designed to develop an interactive, map-based data management system for Heritage, revamping data accessibility, enhancing operational efficiency, and advancing environmental sustainability. In parallel, pressure profile simulations were conducted across all 109 tank batteries to pinpoint vulnerabilities within the pipeline network, mitigate leak risks, and optimise operations, ultimately driving a reduction in carbon emissions.	

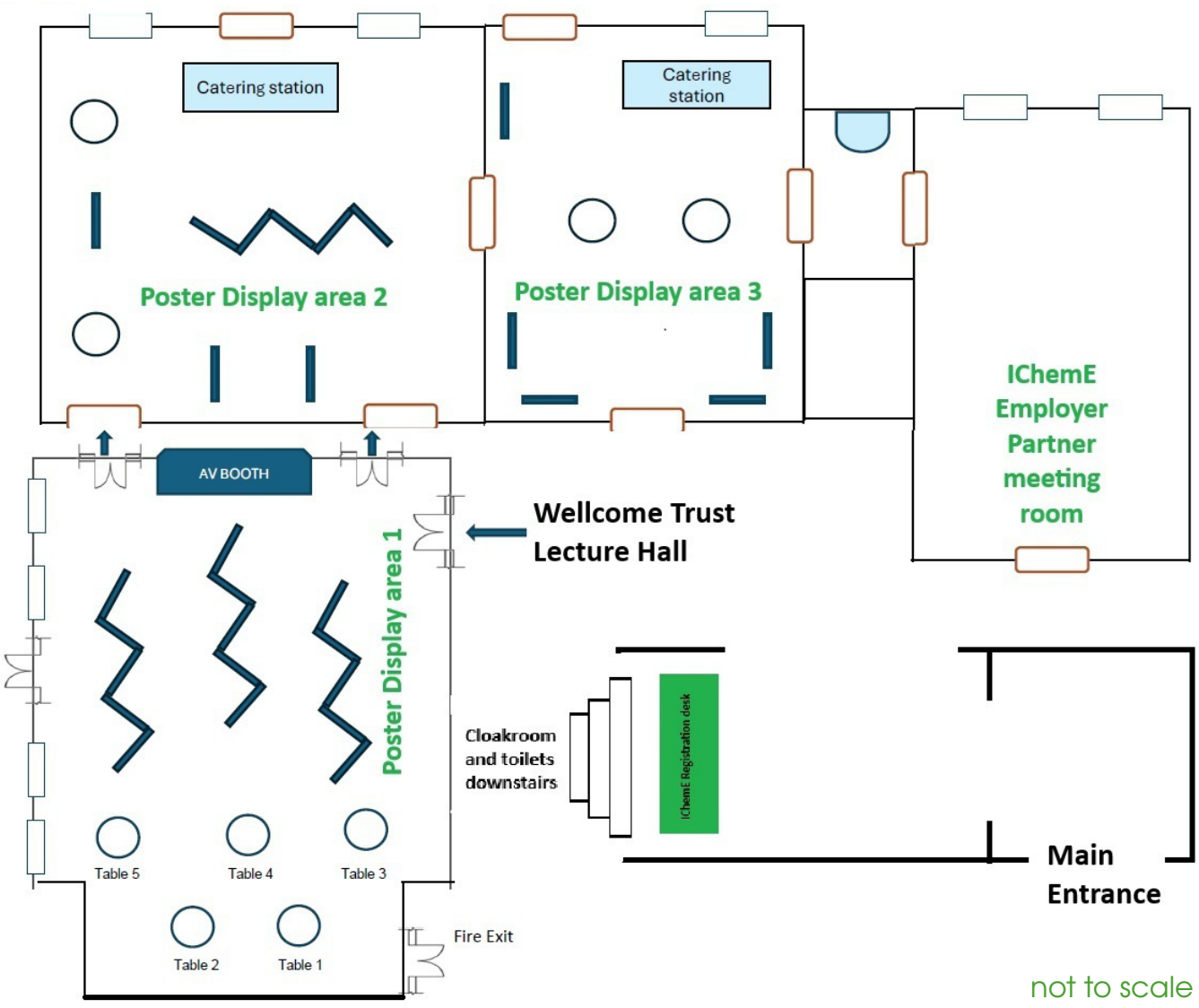
Process safety, including major hazards management

Poster display area – see floor plan	Project Summaries	Country
2	**A budget-constrained optimisation framework for mitigating domino effects in chemical storage facilities** **Shuya Hou (Finalist)** University of Surrey Domino effects in chemical storage facilities can trigger catastrophic fires and explosions. Safety barriers (SBs) and emergency response (ER) are the primary means of stopping things from escalating. This project develops budget-constrained co-optimisation framework (SB+ER) that jointly allocates SBs and ER to minimise escalation risk. Key deliverables include: ■ constructing mixed-integer nonlinear models based on multiple scenarios; ■ investment guidelines for SB and ER; ■ an open-source decision-support tool for safety planning in the chemical industry.	

UK school entry

Poster display area – see floor plan	Project Summaries	Country
2	**The process of decomposing organic textiles using fungi** **St Helen and St Katharine (Shortlisted)** School entry Due to fast fashion, 92 million tonnes of textile waste is landfilled or incinerated and, our landfills are overflowing. Recycling is not always a viable option for clothing disposal. Because of constraints to the recycling industry, 14% of clothing requires incineration, as of 2025. At point of manufacture, quality clothes consist of long staple fibres but, each time an item is recycled fibres are shortened. Short fibres produce low quality clothing with increased pilling and low durability, showing this is not a perfect solution. Our solution of using mushrooms to compost textile waste, tackling the problem of waste fabric.	
2	**Heliomination** **St Mary's College (Shortlisted)** School entry Worldwide, 675 million people live without access to lighting, with 80% being in sub-Saharan Africa (UN, 2023). The abundant sunlight in sub-Saharan Africa means that portable and affordable solar panels are the most feasible method of providing clean energy. Hence, to aid the development of communities, we propose a collapsible, portable, and cheap solar panel made of recycled materials to generate and store electricity. Incorporating clean energy into these communities will not only allow them to develop faster, but also to serve as an example to the rest of the world regarding sustainable development as the UN desires.	
2	**Exploring bioluminescence as a light source** **Wolverhampton Girls' High School (Shortlisted)** School entry At least 1.18 billion people suffer from energy poverty without access to reliable and affordable electricity, and so live in darkness. We aim to create a light source that runs independent of electricity using the emerging technology of bioluminescence, creating numerous socioeconomic benefits and to boost residents' quality of life. To make the design sustainable and feasible to produce, we have chosen locally available resources: bioluminescent bacteria that can be collected from the coast; and upcycling single-use plastic drink bottles for the main structure to reduce landfill, working towards creating a circular economy.	

Floor plan and poster locations



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