For more information go to
www.stemcymru.org.uk

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Waterton Centre
Waterton
Bridgend
CF31 3WT

Tel: 01656 669381
E-mail: info@stemcymru.org.uk

UNDEB EWROPEAIDD
EUROPEAN UNION

Llywodraeth Cymru
Welsh Government

Cronfa Gymdeithasol Ewrop
European Social Fund

Engineering Education Scheme Wales is grateful for the EU funds which have supported STEM Cymru II and the continued support from the Welsh Government.

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EESW
STEM Cymru

Engineering Education Scheme Wales

PROJECT BROCHURE

2022-23

Sponsorship of EESW Awards

North Wales – Venue Cymru, 22nd March 2023

Best Application of Mathematics

Best Application of Engineering and Technology

Ian Binning award for Best Use of Mechanical Engineering Principles (Merseyside & North Wales Region)

Most Innovative or Adapted Design

Best Use of STEM for Sustainability and the Environment

South Wales – Swansea Arena, 27th March 2023

Best Appreciation of Environmental Issues

Best Application of Mathematics

Best Chemical/Process Engineering Design

Best Application of Engineering and Technology

Best Appreciation of Safety Issues

Most Effective Presentation of the Chosen Solution

Best Use of Electrical Engineering Principles

Most Innovative or Adapted Design

Best Overall Team Performance

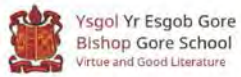
Best Working Model or Prototype

Best Use of STEM for Sustainability and the Environment

Most Innovative Solution to the Project Set

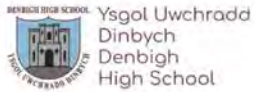
Our Sponsors and Partners

Recognised by



Caldicot School

Cynffig Comprehensive School



Fitzalan High School

Coleg Gŵyr Abertawe
Gower College Swansea

Lewis Girls' School

St David's College

St Joseph's Catholic School and Sixth Form Centre

St Richard Gwyn Catholic High School, Flint

St Teilo's
Church in Wales High School
6th Forms

Y Coleg
Merthyr Tudful
The College
Merthyr Tydfil

Ysgol Friars

Ysgol Gymraeg Gwynllyw

Ysgol Gyfun Gymraeg Plasmawr

Ysgol Uwchradd Caergybi


ABER
Prifysgol Aberystwyth University
AECOM
ARUP
ABP Associated British Ports
Prifysgol Bangor University
BBC cymru wales
BTG
CAF
Dŵr Cymru Welsh Water
Eastman Eastman Chemical Company
Fifth Wheel Co.
Future Valleys | Cymoedd y Dyfodol
Driving Wales forward
Yn gyrru Cymru ymlaen
Gilcrest Manufacturing
Huntleigh A member of the ARJO family
IOE
JCB
KIER
Loft Solutions NW Ltd
EESW
STEM Cymru
Meritor
Microchip
MMB Mott MacDonald Bentley
nationalgrid
big pit national coal museum
amgueddfa lofaol cymru
10 years of Catapult Offshore Renewable Energy
Rhondda Cynon Taf
SAS International
SONY UK Technology Centre
Swansea University Prifysgol Abertawe
Tata Steel
Thales Building a future we can all trust
The Royal Mint Museum
Toyota
C.K
Trafnidiaeth Cymru Transport for Wales
University of South Wales Prifysgol De Cymru
Prifysgol Cymru Y Drindod Dewi Sant University of Wales Trinity Saint David
Vale
Prifysgol Glyndŵr Wrecsam Wrexham Glyndŵr University
Zimmer Biomet

Engineering Education Scheme Wales

The EESW 6th Form Project encourages young people to consider engineering as a career. Professional engineers and representatives from link companies and universities have worked with teams of Year 12 students and their teacher to take on a real engineering problem over a six-month period.

The Project is an approved WJEC Enterprise brief for the Skills Challenge Certificate of the Advanced Welsh Baccalaureate. Students are also able to gain a Gold CREST Award through participation in the scheme by developing a range of essential skills. The Project is also now CPD UK accredited, which allows teachers, engineers, company representatives and volunteer assessors to gain a certification in recognition of their time spent working with us.

This is our final year of funding from the European Social Fund through the Welsh Government which has enabled us to deliver our programmes to over 14,000 young people in West Wales and the Valleys since 2015. I would like to thank the Welsh European Funding Office for their support of the STEM Cymru project since 2010, as well as the Welsh Government Education Directorate for their continued support to extend our reach and create a pan-Wales offering to schools.

Thank you to all the professionals and academics from link companies and organisations for continuing to work with us to deliver this project. We are really pleased that following the disruption caused by the pandemic, levels of engagement have increased greatly this academic year across all our activities. This includes the large number of teams this year attending our North and South Wales Awards and Presentation events as detailed on the following pages of this brochure.

We are delighted that many organisations have kindly sponsored a variety of awards again this year. We gratefully acknowledge the support of all the schools, universities, companies and sponsors shown on the following pages, who have allowed us to continue offering this opportunity to young people across Wales.

We recently launched a stakeholder survey to determine the impact of the loss of our provision and have been overwhelmed with the support and positive comments received from our key delivery partners. If you would like to contribute, please visit the Funding and Partners page on our website.

Finally, congratulations to all our young people who have participated this year and good luck for the future and here are some words from the Minister for Education and Welsh Language, Jeremy Miles MS.

"*STEM (Science, Technology, Engineering and Mathematics) subjects can open up so many doors to exciting study opportunities and rewarding jobs. This is one of the main aims of the Curriculum for Wales, to support learners to be resilient, creative and ambitious, requiring them to solve problems, engage with different information and work independently. This will help prepare them to respond to the opportunities and challenges of a changing economic reality. This is why it is so important that more young people in Wales understand STEM principles such as engineering, physics, aerodynamics, design and manufacturing and what these can offer them, alongside developing crucial skills such as teamwork and leadership.*

I wish all the participants and finalists the best of luck; it's an amazing opportunity for them and I hope for many of our learners it is the first step into an inspiring future."

R F Davies

Rebecca Davies
EESW Chief Executive Officer

EESW Teams 2022-23

North Wales – Venue Cymru, 22nd March 2023

EESW Teams 2022-23

South Wales – Swansea Arena, 27th March 2023

EESW Teams 2022-23

South Wales – Swansea Arena, 27th March 2023

North Wales

Conwy

Team 1

St David's College
& Ore Catapult

Recycling Wind Turbine Blades

Team: Arthur Baskerville
Edwin Thompson
Harry Boyle
James Taylor
Jasmine Sutton
Milly Hay
Thomas Barclay
Thomas Pearce

Teacher: Robert Hughes

Company link: Emma Lewis, Rebecca Jeffrey and Diego Miguez

ORE Catapult is the UK's leading technology innovation and research centre for offshore renewable energy (including wind, wave and tidal energy).

Disposing of retired wind turbine blades has become a dilemma for the renewable energy industry, as they are made of materials that cannot easily be recycled. Up to 85% of an existing wind turbine can be recycled, but not the turbine blades, which already account for 10% of Europe's fibre-reinforced composite material waste. In the past, blades which include fiberglass or glass reinforced polymers (GRP) have been dumped in landfills or incinerated.

The project will involve the use of alternative materials that would be 100% recyclable, Finding alternative uses for the non-recyclable blades after decommissioned requirements. The teams will include the costs involved in the different recycling processes for the proposed solutions.

Conwy

Team 2

Ysgol Bryn Elian
& JCB Transmissions

Augmented reality headsets as training aids

Team: Caz Dutton
Christopher Jones
Ffion Boardman
Ianto Evans
Jared Jones
Joseph Elliott

Teacher: Neil Humphreys

Company link: David Jones and Alex Hollobone

JCB is a British multinational manufacturer of equipment for construction, agriculture, waste handling, and demolition, founded in 1945.

Training of operators is an essential part of JCB, ensuring everyone has the correct skills and knowledge. Currently operators are trained using old fashioned methods which are predominantly classroom based, we would like to update and provide a more hands on approach.

To design, implement and test an augmented reality system which incorporates a VR/AR headset being linked to a web-based browser.

To design, build and manufacture a training trolley for assembling a clutch. The top of this trolley will be designed to house all the components to assemble the clutch and components positioned in line with the build sequence. From this an operator working on the assembly line can live stream themselves building a clutch and the trainee, in the training room, can build their own clutch at the same time. The trainee will be using the components from the trolley and the equipment in the training room.

North Wales

Conwy

Team 3

Ysgol Dyffryn Conwy
& Mott MacDonald Bentley

Effective and Efficient Mixing for Chemical Dosing within Wastewater Treatment

Team: Adam Karshe
Aron Jones
Bobby Halsall
Callum Richards
Daniel Blair
Jac Goodwin
Rowan Shepherd

Teacher: Penri Jones

Company link: Prys Roberts,
Matthew Tokaryk, Robert Bishop
and Megha Rose Paul

MMB's work is predominantly in the water and wastewater sectors with projects varying in scale and complexity. Include schemes to remediate the UK's dam and reservoir infrastructure and upgrade and expand multi-million-pound treatment works to provide clean drinking water and raw sewage.

Some of the methods used for wastewater treatment require the addition of chemicals into the wastewater to aid in solid particle removal. To ensure that the chemicals are effective and that the correct amounts are added for treatment, the chemicals must be well mixed within the wastewater flow.

Design and build a clear channel to simulate a channel at a wastewater treatment works into which static mixers can be installed. Different designs of static mixers are to be placed into the channel and water added to observe how the mixers impact the flow of water. This can then be expanded upon by adding dye upstream of the mixer to simulate chemical addition and observe how efficiently the dye mixes into the water.

Conwy

Team 4

Ysgol Eirias 1
& Bangor University - Computer Science

Gamification

Team: Alfie Herbert
Euan McGowan
Ryan Neumann

Teacher: Andrew Dawson

Company link: Cameron Gray

Bangor University was founded in 1884. Around 10,000 students currently study with us and our teaching and research is grouped into nine academic Schools.

Gaming is becoming more and more popular and normalized in modern society, with gaming being used in educational environments with games like Minecraft education edition, and with military application to educate soldiers and to recruit prospective soldiers with games like America's Army and Marine Doom.

Our team has been tasked with creating an advertisement for the EESW. By educating players on different aspects of the STEM education. We will create a game showing a brief overview of all four topics; Science, Technology, Engineering and Mathematics.

North Wales

Conwy

Team 5

Ysgol Eirias 2
& Bangor University - Computer Science

Gamification

Team: Evan Lyons
Finlay Jones
Joseph Whitehall
Steffan Owen

Teacher: Andrew Dawson

Company link: Cameron Gray

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Conwy

Team 6

Ysgol Y Creuddyn
& Bangor University - Product Design

'V-Rack' Van Storage

Team: Aled Bibby
Ben Fitzpatrick
Benjamin Lewis-Jones
Erin Parry-Lord
Ifan Jones
Taliesin Bateman

Teacher: Gwyndaf Owen

Company link: Peredur Williams

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Loft Solutions NW is an Anglesey based company specialising in loft access and storage.
Tradespeople usually uses their vans for trade and personal/leisure activities.

The task is to design a multipurpose system for medium sized vans (Transit) which can hold tools and materials for weekday commercial use, which can be easily and quickly removed for leisure or transporting large items.

North Wales

Denbighshire

Team 7

Denbigh High School & Toyota

Consider manufacture process to assist participation of Toyota member

Team: Elin Wisby
Jake Jones
Jasmin Jones
Owen Carpenter
Owen Brumby

Teacher: Gareth Jones

Company link: Sarah Overson, Dhruvit Shah, Steph Whieldon and Steve Leake

Toyota Motor Corporation is a Japanese multinational automotive manufacturer who aim to exceed expectations and be rewarded with a smile.

Production (type 3) member must currently pick and place 52 bolts into the oil jets to prepare the parts for engine assembly. This must be done in a maximum of 10 seconds (line runs at 44s – oil jets per assembly. This allows time for part transfer).

The brief is to design and manufacture a piece of equipment that will sub assemble the bolts into the oil jets ready for the member on process to assemble.

Denbighshire

Team 8

Ysgol Glan Clwyd & Fifth Wheel Company

Devise a prototype - a working off-grid water system that can be integrated with the Celtic Rambler

Team: Erin Baxter
Gwion Williams
Jacob Chow
Luke Lightbown
Luke Molmans
Natassia Moore

Teacher: David Williams

Company link: Gethin Whiteley, Ciron Hywel and Dave Robinson

The Fifth Wheel Company designs and manufactures luxury fifth wheel and touring caravans.

Recent trends within the caravan and motorhome industry have seen more of our customers demand to live completely self-sufficient and “off grid”. This has been further compounded by the current economic situation and climate crisis making customers more conscientious of their energy usage, the cost of energy and environmental impact. We have not investigated off-grid water usage and management.

The project is to devise and prototype a working off-grid water system that can be integrated with the Celtic Rambler so that the user(s) can live self-sufficiently for as long as feasibly possible using one full 230ltr tank of fresh water (water filtration, water harvesting and any other potential sources) and no available mains water source.

North Wales

Flintshire

Team 9

St Richard Gwyn Catholic High School & Tata Steel, Shotton

Energy Saving and Recovery

Team: Caleb Spencer
Callum Johnson
Ethan Vaughan
Joseph Humphreys
Symon Nowak

Teacher: Martin Welch

Company link: Julie Baddock and Billy Payne

Tata Steel Shotton is a subsidiary business to Tata Steel UK. At Shotton, we do not manufacture the steel coils but instead further process them to make more valuable products.

Tata Steel Shotton uses a massive amount of energy and power for its production lines. The current market situation has meant that energy bills have increased by more than double. The main source of fuel on site is Natural Gas and this is used extensively on all 3 production lines. One such area is the Galvanising line where it is used in 2 furnaces to heat the steel strip to extremely high temperatures. The hot waste products, from the combustion of natural gas, could be used to make other energy efficient savings. Tata Steel Shotton also relies on mass amounts of electricity to power the site.

Develop ideas on how this can link to the above and how we can be self-reliant.

Gwynedd

Team 10

Coleg Meirion Dwyfor - Dolgellau & Aberystwyth University

Inspecting the COVID pandemic through genome data

Team: Ceri Williams
Harriett Rushton
Olaf Niechcial
Oliwia Stone
Rebecca Grooms
Sion Gunton
Skylar Garrett

Teacher: Huw Hughes

Company link: Tally Roberts
and Dr Amanda Clare

The virus that causes COVID is called SARS-CoV-2. It has a small genome, of approximately 30000 DNA bases, which can be sequenced relatively cheaply. The UK continues to sequence SARS-CoV-2 genomes from a selection of people who catch COVID, to find out what variants are currently prevalent and what new variants might be emerging.

The genomes are made available to the public, along with information such as, the date of sample, and region of the UK (this is the “metadata”). We want to use the metadata to find out how the genome sequences have changed over time, and display that information in graphs, charts or interactively in a way that tells the story of the variation that has been present and is soon to come.

The group will investigate what kind of information the data files contain, what kind of questions we can ask of the data, and what kinds of graphs and summaries are possible and may be useful in displaying the answers. The group will then design, write and test code to process the data and present their findings.

North Wales

Gwynedd

Team 11

Coleg Meirion Dwyfor - Pwllheli
& Aberystwyth University

Inspecting the COVID pandemic through genome data

Team: Elis Thompson
Jerzy Niechcial
Joel Roberts
Jonathan O'Mara
Tomos Eardley
Tomos Morris
Tomos Roberts

Teacher: Huw Hughes

Company link: Tally Roberts
and Dr Amanda Clare

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Gwynedd

Team 12

Coleg Menai
& Wrexham Glyndwr University

Challenges faced by the people of El Alto, Peru

Team: Amelia Davie
Cilan Garbutt
Gwenllian Jones
Gwern Erwin Williams
Heledd Haf Owen
Tesni Pari-Jones

Teacher: Rhodri Llwyd

Company link: Joy Brereton and Daniel Knox

Wrexham Glyndwr University's mission is to inspire and enable through higher education, research and engagement; working together with our students, staff and partners.

Consider the challenges faced by the people of El Alto on the northern coast of Peru. How might we design, engineer and produce a community led solution that represents an improvement to their day to day living, including those most in need?

Consider the area and what local resources of material, labour and natural reserves are available to exploit. Fully justify the design solution ensuring its appropriate to the local area.

North Wales

Gwynedd

Team 13

Ysgol Friars 1
& National Grid

Electricity cable excavation and duct laying challenge

Team: Chloe Hooton
Kanishk Patil
Marcus Maniago
Thea Hummel

Teacher: Shaun Holdsworth

Company link: Mike Cheshire and Michael Tuke

National Grid owns and maintains the high-voltage electricity transmission network in Wales and England. National Grid are investing in the network, connecting more low carbon electricity.

National Grid are replacing the existing underground cables, installed in the 1970's, between Dinorwig power station and the substation at Pentir.

When working on the highways, the teams dig trenches in sections to minimise the disruption to road users. To install cable ducting, which the new cables will be fed through later in the project. The teams move along roads as they complete each section, which will include refilling the trenches and resurfacing the carriageway.

Devise new methods to excavate and lay ducts for putting new high-voltage electricity cables in a variety of ground conditions. They should be just as safe and cost-effective, be less disruptive for local communities, have the same or a reduced environmental impact, and take no longer than current methods to ensure the project meets its programme.

Gwynedd

Team 14

Ysgol Friars 2
& National Grid

Electricity cable excavation and duct laying challenge

Team: Ariel Lichtenstein
Cai Gray
Finlay Burke
Henry Downing

Teacher: Shaun Holdsworth

Company link: Mike Cheshire and Michael Tuke

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North Wales

Gwynedd

Team 15

Ysgol Friars 3
& Bangor University - Product Design

Wearable tool storage

Team: Celyn Jepson
Matilda Hellfeld
Sophie Patterson
Ursula Rowe

Teacher: Shaun Holdsworth

Company link: Peredur Williams

Bangor University was founded in 1884. Around 10,000 students currently study with us and our teaching and research is grouped into nine academic Schools.

Carl Kammerling International was founded in Germany in 1904, they provide a wide range of hand tools, tool storage, power tool accessories and security products suitable for professional, industrial and consumer use.

C.K Tools are passionate about making work quicker, easier, and safer. One common way of doing this is by using wearable tool storage, this reduces downtime, and keeps all the necessary tools on your person. C.K Tools have an issue however where none of our wearable tool storage is dedicated to a specific trade.

The project is to develop a wearable tool storage solution which effectively holds a select amount of tools for an electrician, which is adaptable for the different type of work being carried out.

Gwynedd

Team 16

Ysgol Friars 4
& Bangor University - Product Design

'V-Rack' Van Storage

Team: Adam Ryan
Iestyn Stubbings
Iwan Lewis
Kian Bajo
Luke Allsop

Teacher: Shaun Holdsworth

Company link: Peredur Williams

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Design a multipurpose system for medium sized vans (Transit) which can hold tools and materials for weekday commercial use, which can be easily and quickly removed for leisure or transporting large items.

North Wales

Gwynedd

Team 17

Ysgol Friars 5
& Bangor University - Product Design

'V-Rack' Van Storage

Team: Huw Bragg
Jac Gray
Luke Hutchinson-Rogers
Thomas Knights
Teacher: Shaun Holdsworth

Company link: Peredur Williams

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Isle of Anglesey

Team 18

Ysgol Uwchradd Caergybi
& Bangor University - Product Design

Ladders

Team: Connie Whitfield
Connor Silence
Daniel Jones
Jack Brodie
Osian Reid
Rhys Jones

Teacher: Zalli Jones

Company link: Peredur Williams

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Carl Kammerling International was founded in Germany in 1904, they provide a wide range of hand tools, tool storage, power tool accessories and security products suitable for professional, industrial and consumer use.

Working safely at height in the garden is a challenge with existing step ladders, a large percentage of injuries from gardening in the UK stem from falls from ladders or working at height.

Design and develop a way in which user/s can operate from a ladder safely in the garden and/or outside of the house.

Designing and developing new and innovative methods of making step ladders safer to us.

South Wales

Blaenau Gwent

Team 1

Coleg Gwent Ebbw Vale 1 & Thales

Energy Saving Solutions

Team: Meng-ji Chen
Guan Fan
Rhys Phillips
Mirela Popescu
Ieuan Schwank

Teacher: Shaun Andrews and Stephanie Werrett

Company link: Dene Yandle

Thales Group is a French multinational company that designs and builds electrical systems and provides services for the aerospace, defence, transportation, and security markets. Thales aim to continually improve quality and work more efficiently.
The cost-of-living crisis is affecting almost everyone, but some are much more deeply squeezed than others, with poorer and prime age

(25-55) adults hit especially hard. Just over three-quarters of UK adults said in November that they

were trying to cut back on spending.
Provide solutions to assist savings during the energy crisis. Consider where and how energy could be saved in everyday situations.

Blaenau Gwent

Team 2

Coleg Gwent Ebbw Vale 2 & Thales

Energy Saving Solutions

Team: Chloe Burchell
Erin Hall
Mason Powell
Emily Rowland
Dawid Skowron

Teacher: Shaun Andrews and Stephanie Werrett

Company link: Dene Yandle

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South Wales

Blaenau Gwent

Team 3

Coleg Gwent Ebbw Vale 3 & Thales

Energy Saving Solutions

Team: Joshua Davies
Abilash Ganeshalingham
Ellie Hughes
Asyia Ilahi
Jemima Thomas

Teacher: Shaun Andrews and Stephanie Werrett

Company link: Dene Yandle

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Blaenau Gwent

Team 4

Coleg Gwent Ebbw Vale 4 & Thales

Energy Saving Solutions

Team: Felicity Ford
Luke Heasley
Jack King
Chloe Simmonds
Kasia Tomsa

Teacher: Shaun Andrews and Stephanie Werrett

Company link: Dene Yandle

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South Wales

Bridgend

Team 5

Brynteg School 1
& SAS International

Industrial Waste Recycling and Repurposing

Team: Carys Elias
Catie Williams
Jolene Quick
Milly Bayliss
Rebecca Barton

Teacher: Paul Webber

Company link: Bethan Grant, Geraint Lewis and Garin Bowen

SAS International is a market leading, internationally operative British manufacturer of interior building products. Within the industrial processes used by SAS International in the manufacture of acoustic suspended ceilings there are number of streams of waste material. The recycling and disposal of this waste material is a high cost to SAS International This project is to focus on one or more of those waste materials and utilise the material in the design of another product either as part of the SAS product portfolio or as a new product in another environment.

The waste streams targeted include:

1. Steel waste. The punching process of sheet metal creates a large volume of small steel discs.
2. Powder coating waste. The spraying of powder coating creates powdered waste material that cannot be reused within the factory as it would need cleaning before use.
3. Insulation material. The use of Rockwool and other similar materials that are used for their acoustic, thermal and insulation properties creates a large volume of multi sized waste sections that can be returned to the supplier for recycling but at the cost of transportation.

Bridgend

Team 6

Brynteg School 2
& University of Wales Trinity St David
- Applied Computing

Smart Tanks

Team: Daniel Honeyfield
Isabel Ashong
Jodie Keane
Joseph Knight
Leo Richards
Maisie Davies
Shayon Dhar

Teacher: Paul Webber

Company link: Dr Nitheesh Kaliyamurthy and Dr Kapilan Radhakrishnan

The University of Wales Trinity Saint David is an employment-focused university that furnishes students with all the knowledge and skills to thrive after graduation. The School of Applied Computing aims to produce graduates that help shape the future of computing and information systems development.

Increasing levels of industrial automation are driving improvements in productivity, product quality, and safety. In recent times, automated solutions have proliferated into a much wider range of industries, including the food and beverage sector.

Cobots (collaborative robots) are a type of robot intended for direct human-robot interaction. Cobots are becoming increasingly popular. Organisations deploy them across a vast number of applications to automate repetitive/manual tasks. The task is to develop a Cobot (in a Simulated environment or a Prototype model) coffee machine tending solution capable of fully automating a traditional, human-operated coffee machine.

South Wales

Bridgend

Team 7

Coleg Cymunedol Y Dderwen & Sony UK Tec

Automated Pallet transport system

Team: Amelia Webb
Isobel Penny
Jessica Evans
Olivia Herbert
Olivia Webb

Teacher: Hazel Deeming, Chloe Pritchard and Paul Davies

Company link: Ricky White

This project is designed to eliminate a mundane manual issue; the movement of pallets from a production line into a warehouse location.

The following points must be considered: Safety of all operators, people suddenly in the path of the machine and things moved into the wrong places.

In order to get a system into a working environment it must contain:

1. Emergency stop systems.
2. Redundancy (multiple systems).
3. Smooth movement.
4. The ability to respond to changes in the environment.
5. Able to be programmed easily.

The brief is to build a small robot that can transport a group of boxes measuring 30mm *36mm *29 mm, these will be stacked 4*2 and three sets high, these will be moved safely without tipping from one area to another, around two corners with the ability to pick up and lower the boxes.

Bridgend

Team 8

Cynffig Comprehensive School & Zimmer Biomet

Oxford Cementless Inserter Instrument

Team: Ellis Cresswell
Filip Wator
Finley Turner
Jack Cavill
James Davies

Teacher: Dan Morrish

Company link: Sian Williams, Annabelle Boardman and David Smith

The current Oxford Cementless Inserter instrument has a couple of issues that need to be resolved. Firstly, the instrument obscures the view of the surgeon when inserting the tibial tray component. Secondly, there are hooks on the instrument which engage with the tibial tray and the surgeon is fracturing the instrument removing the posterior side of the tibial tray.

The root cause of the failure is unknown but suspected to be that the inserter is being used as an impaction tool and/ or bending and/ or over tightening of the tool.

Design a new method of placing the tibial tray component, without the requirement to change the design on the tibial tray component.

Students will need to consider: Cleanability and sterilisation, Reusability, Material selection and suitability for the human body, Ease of use and repeatability.

South Wales

Caerphilly

Team 9

Lewis Girls' School
& BBC Cymru Wales

Remote Weather Clicker

Team: Aleena Ali
Ioan Beecham
Arwen Bertram
Holly Davies
Phoebe Dooley
Carys Edminson
Olivia Harvey
Arooj Shahed Emily Thomas

Teacher: Steve Pole

Company link: Brian Davidge and Mark Ireland

BBC Cymru Wales is a division of the BBC, and the national broadcaster for Wales, its mission is to fire a nation's imagination. As the nation's most trusted and valued broadcaster, BBC Cymru Wales exists to help audiences discover and to champion the best talent and the boldest ideas for national and UK audiences. And we do all this on a platform big enough to make a difference, not just to our audiences, but to Wales itself. The technology team provides technical support, operational services, software development and project management to all the teams in BBC Cymru Wales.

Our weather presenters are often on location around all parts of Wales when they present the weather. However, when doing this, they don't have access to their 'weather clicker' button which makes the weather slides animate for the viewing audience. In this case they rely on staff in the broadcasting centre to press the weather clicker for them. We would like to improve this by providing the weather presenters with a method of advancing the weather slides themselves while on location.

Cardiff

Team 10

Fitzalan High School 1
& Kier Construction

Building a Sustainable World

Team: Amir Sarwar-Skuse
Inayat Choudhury
Musa Mustafa
Rahim-UI Islam
Toni Aiyeola
Umar Butt

Teacher: Jordan Wright

Company link: Jessica O'Donnell
and Nick Hamersley

Kier Construction are the UK's largest regional builder, with a network of 88 offices across the UK, delivering over £2bn of projects annually to both private and public-sector clients. Our local Office is based in St Mellons, Cardiff. We are a leading provider of infrastructure services, construction and property developments and committed to delivering for communities and leaving lasting legacies.

The construction industry are always working hard to reduce their impact on the environment and to build for a sustainable world. We are continually faced with the changing requirements to reduce our carbon emissions and use of plastics.

As part of your STEM Project, we would like you to help us in producing a prototype to either: Reduce Carbon emissions on site, reduce our use of plastics or develop a way to re-use/recycle plastics on site.

South Wales

Cardiff

Team 11

Fitzalan High School 2
& Kier Construction

Building a Sustainable World

Team: Adil Rahman
Shaan Kunvarji
Tamzid Choudhury
Idris Mezhoud
Malek Bennasar

Teacher: Jordan Wright

Company link: Jessica O'Donnell
and Nick Hamersley

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Cardiff

Team 12

Howell's College
& Transport for Wales Rail Services

Rail height level measurement

Team: Abi Martin
Amelie Russell
Daisy Buick
Menak Sutton
Percy Chung
Pierre Frament

Teacher: Andrew Ford

Company link: Tom Parker

Our purpose is to provide sustainable transport services that keep Wales moving. We operate train services across the Wales and Borders network, serving commuter and long-distance passengers. In order to transform the service we offer, we are introducing new rolling stock which will be more comfortable, efficient and reliable.

The brief is to design and prototype a tool for measuring the track twist and cant (angle) in Canton depot in order to allow improved calibration of measurements on the class 231.

The design shall:
Be deployed and removed in compliance with TFW's depot safety rules;

Give a sufficiently precise and reliable reading to be relied upon;

Be portable and self-powered.

South Wales

Cardiff

Team 13

Llanishen High School 1 & AECOM

Design a Sustainable Street Within an Urban Setting

Team: Ben Lee
Bethan Jones
Emily Dent
Liam Martin
Harry Paget

Teacher: Richard Lawson

Company link: Sian Lewis and Bleddyn Rees

AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries. AECOM Cardiff is a multidisciplinary office based near the city centre railway station.

Water is a finite resource. Developments require a holistic sustainable approach, and in the future must particularly consider the prevention of excess water loss, combined with the promotion of utilising wastewater in a recycled form. The challenge requires the design of a sustainable street within an urban setting. There are various types of wastewater, including grey water, black water and in the form of runoff whether from roads or roofs. Research the variety of solutions you could integrate into your design for each element of the street, and recommend the most suitable. Consider incorporating a sustainable urban drainage system into your design in addition to the sustainable solutions that could be applied to the buildings and the surrounding environment. You are advised to consider the fabric make up of elements within the design and may also wish to include features to encourage the user to reduce their carbon footprint. Remember to assess the social, economic and environmental benefits of your design, whilst ensuring it remains aesthetically pleasing.

Cardiff

Team 14

Llanishen High School 2 & AECOM

Off Grid Education

Team: Aland Ghaleb
Alex Workman-Cosh
Josh Parry
James Gunney
Ciaran Selwood

Teacher: Richard Lawson

Company link: Sian Lewis and Bleddyn Rees

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A local Welsh secondary school is looking to extend its existing building to supplement increasing pupil numbers. The site for the new school extension is located near the sea in an open and rural environment. The challenge lies in how, as a building design engineer, you can capture enough renewable & sustainable energy to power the school and it's mechanical and electrical building services equipment. The Equipment has been chosen and designed to ensure a suitable and comfortable teaching environment for the occupants but requires a method of power by which this equipment is not drawing upon the mains electricity network. The aim of this project is to come up with a concept design for a small-scale educational building that generates, stores and releases its own energy.

South Wales

Cardiff

Team 15

Llanishen High School 3 & AECOM

Off Grid Education: Applied to Llanishen High School

Team: Finley Cocker
Harrison Edmunds
Alex Russell
Callam Sparey
Finley Cocker
Harrison Edmunds

Teacher: Richard Lawson

Company link: Sian Lewis and Bleddyn Rees

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Cardiff

Team 16

St David's Catholic College 1 & IQE

Reduction of IQE's Scope 1, Scope 2 and mandatory Scope 3 Emissions

Team: Emily Beal
Cairon Murphy
Josh Jones
Megan Grennan

Teacher: Batool Akmal

Company link: Andrew Hindle, Scott McKinnon, Jade Robinson, Andrew Mason and Leigh Jackson

It is widely recognised that the World faces an unprecedented challenge in tackling Climate Change.

IQE has already taken a number of steps to minimise our impact, and during 2021 we carried out a baselining exercise to fully understand our Scope 1, Scope 2 and mandatory Scope 3 emissions. We have recently committed to achieving Science Based Targets, this is a huge commitment for any organisation to undertake and we are actively reviewing many aspects of our business to inform and develop our Net Zero Roadmap. Across the globe our three primary emission factors (CO_2e) are electricity usage, gas and air freight.

The brief is to investigate and discuss novel and innovative improvement opportunities which could be explored by IQE in the future to reduce our scope 1,2 and 3 emissions, considering how they could help us to achieve our goals, cost/benefit analysis and further consider the strengths, weaknesses, opportunities and threats posed by each.

South Wales

Cardiff

Team 17

St David's Catholic College 2
& IQE

Reduction of IQE's Scope 1, Scope 2 and mandatory Scope 3 Emissions

Team: Cormac Edwards
Eliot Golding
Francesca Moreau
Harrison Parkes
Leigha Sanejo

Teacher: Batool Akmal

Company link: Andrew Hindle, Scott McKinnon, Jade Robinson, Andrew Mason and Leigh Jackson

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Cardiff

Team 18

St John's College
& Mott MacDonald Bentley

Waste Water Pipeline Design

Team: Varshnay Singha
Neel Saldanha
Ashlin Jose
James Feng
Renxi Yu

Teacher: Rhian Bate

Company link: Augustas Struckus, Damien Aubouin, Matthew Roberts and Abbi Wysome

The Waste-water Treatment Works (WwTW) in Town A and Town B are both at the end of their designed lifecycle and require upgrades due to growth in the area. It has been decided that Town B treatment works is to be demolished and all the incoming wastewater at Town B will be diverted to Town A for treatment whilst Town A will undergo an upgrade to manage the increased incoming flows.

Approximately 5km of new pipeline will be built between Town A and Town B treatment works to transport the wastewater.

Due to the current profile of the ground, a section of the pipeline will be pumped from Town B WwTW, whilst the remaining section will be gravity fed to Town A WwTW. By researching the ground profile and environmental constraints using the online resources and any other available information, design the best route for the pipeline which would have the least impact on local residents and environment, whilst remaining practical for construction.

South Wales

Cardiff

Team 19

St Teilo's CIW High School & Eastman Chemical Company

Resin Bead Capture

Team: Abdulmalik Altekbali
Ellayib Ali
Georgia Emmott
Rhys Dunn
Samir Abdellaty
Samuel Grand
Zoe Edwards

Teacher: Samantha Barry

Company link: Matthew Griffiths

Eastman Chemical Company operates five main production plants, which use organic and / or inorganic processes. These manufacturing processes include: pyrolysis, aqueous or anhydrous reactions, esterification, hydrogenation, drying, distillation and filtering. Other associated activities include: Boiler-house and Effluent Treatment operations. The site produces approximately 100000 tonnes of chemical products annually.
Resin Beads are used in some areas of the site.

The brief - to capture plastic beads entrained in a water effluent. This is to prevent processing issues and the beads entering the wider environment. The beads are a minimum of 1mm diameter. The beads can either be captured on route to a tank or skimmed from the tank.

Cardiff

Team 20

Whitchurch High School 1 & The Royal Mint Museum

17th Century Royal Mint Production Method Concept

Team: Angharad Roberts
Billy Pocknell
Grace Bradley
Joel Hopkins
Lily Neville-Thomas
Sam Nelson

Teacher: Mike Williams

Company link: Amy Williams

Some coins are produced with lettering around the edge. This is usually done where the letters are incuse or pressed into the metal. However, it is possible to produce a coin with raised edge lettering, where the letters stand proud of the surface of the coin.
This technique was first produced back in the late 17th century when the Mint was housed inside the Tower of London.

This is a very difficult thing to do, especially when mass-producing coin at high quantity. The Mint has done this using different methods over the years.
The team must research the ways in which the Royal Mint has applied raised edge lettering to coins and create a way of demonstrating this to an education audience.

We want you to focus on the approach taken in the 17th century and produce a small demonstration exhibit to be used in education workshops with children and family audiences.
This will need to be small enough to fit onto a tabletop and be easily moved and stored.

South Wales

Cardiff

Team 21

Whitchurch High School 2
& The Royal Mint Museum

17th Century Royal Mint Production Method Concept

Team: Harry Clifton
Lucas Bryan
Marley Wheeler
Matthew Whitbread
Tom Aston

Teacher: Mike Williams

Company link: Amy Williams

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Cardiff

Team 22

Ysgol Gyfun Gymraeg Plasmawr 1
& Dwr Cymru Welsh Water

Maintaining and enhancing the water supply for Cardiff

Team: Eiry Thomas
Elen Edwards
Gwenllian Lingard
Lily Rees-Thomas
Megan Jones
Owen Morris
Rhian Evans
Sophie Knoyle

Teacher: Gareth Hall Williams
and Daniel Selway

Company link: Stephne Puddy, Samuel Tudor
Andrew Bowen, Rhodri Perry
and Stephen Shakespeare

Dwr Cymru Welsh Water is the sixth largest of the ten regulated water and sewerage companies in England and Wales. Responsible for providing over three million people with a continuous, high quality supply of drinking water and for treating and properly disposing of the wastewater that is produced. We are fully committed to delivering best quality service at least possible cost.

Dam Safety Team are responsible for managing a stock of 138 statutory reservoirs across Wales. The spring and summer of 2022 has seen much lower levels of rainfall across the UK and Wales than is typical. Your task is to find a way to enhance the utilisation, build new assets or provide other innovative solutions to create a sustainable and reliable water resource for future generations.

Pupils should consider the following: Current resource, Current demand, Future demand, Impacts of global warming, Environment and ecology, Risks/ Opportunities, Optioneering and Develop a solution(s) to meet the needs of our customers.

South Wales

Cardiff

Team 23

Ysgol Gyfun Gymraeg Plasmawr 2
& Dwr Cymru Welsh Water

Maintaining and enhancing the water supply for Cardiff

Team: Andrew Dyban-Sully
Cai Phipps
Luke Stentiford
Morgan Jones
Rhodri George

Teacher: Gareth Hall Williams
and Daniel Selway

Company link: Stephne Puddy, Samuel Tudor
Andrew Bowen, Rhodri Perry
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Cardiff

Team 24

Ysgol Gyfun Gymraeg Plasmawr 3
& Dwr Cymru Welsh Water

Maintaining and enhancing the water supply for Cardiff

Team: Liam Al-Shawi
Lloyd Brockhurst
Osian Lloyd-Owen

Teacher: Gareth Hall Williams
and Daniel Selway

Company link: Stephne Puddy, Samuel Tudor
Andrew Bowen, Rhodri Perry
and Stephen Shakespeare

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South Wales

Cardiff

Team 25

Cardiff Sixth Form College 1
& Huntleigh Healthcare

Ultrasound Transducer

Team: Chukwuebuka Okoroigwe
Donald Toh
Ian Wong
Ming Lee
Pranaav Govindan
Renyi Cui
Tsun Tam
Xiangyi Zhan

Teacher: Gareth Jenkins

Company link: John Iles

Huntleigh Healthcare are a member of the Arjo Group, manufacturer of Medical Devices. Huntleigh manufacture a range of Fetal Doppler's that allow midwives to monitor fetal wellbeing. Huntleigh healthcare is a leading global provider of innovative and high-quality medical equipment for healthcare professionals. The company provide solutions that can assist clinicians in improving outcomes and enhancing patient wellbeing.

The device currently requires the user (midwife, obstetrician) to hold/position the transducer whilst monitoring is performed.

The project is to develop a transducer that allows monitoring to take place without the need for the midwife to constantly hold/position the transducer.

Cardiff

Team 26

Cardiff Sixth Form College 2
& Huntleigh Healthcare

Ultrasound Transducer

Team: Haoting Shao
Ihenacho Stanley
Oluwatomi Fabamigbe
Tak Ho
Tze Wong
Yanqing Yu
Yongqi Chen

Teacher: Gareth Jenkins

Company link: John Iles

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South Wales

Cardiff

Team 27

Cardiff Sixth Form College 3
& Huntleigh Healthcare

Ultrasound Transducer

Team: Hok Kwan
Patrick Fung
Peichen Wu
Timileyin Ojofeitimi
Uti Chio
Xiang Li
Yuk Chen

Teacher: Gareth Jenkins

Company link: John Iles

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Carmarthenshire

Team 28

Ysgol Dyffryn Aman
& University of Wales Trinity St David
- Applied Computing

Smart Tanks

Team: Celyn Lewis
Freya Jones
Ryan Carvey
Toby Davies

Teacher: James Thomas

Company link: Dr Nitheesh Kaliyamurthy
and Dr Kapilan Radhakrishnan

Increasing levels of industrial automation are driving improvements in productivity, product quality, and safety across the manufacturing sector. In recent times, automated solutions have proliferated into a much wider range of industries, including the food and beverage sector.

Cobots (collaborative robots) are a type of robot intended for direct human-robot interaction within a shared workspace. Cobots are becoming increasingly popular as organisations deploy them across a vast number of applications to automate repetitive/manual tasks, attributed to their cost-effectiveness, flexibility, and safety.

The task is to develop a Cobot (in a Simulated environment or a Prototype model) coffee machine tending solution capable of fully automating a traditional, human-operated coffee machine. Few key challenges your solution may address include: Presenting standard disposable coffee cups to the coffee machine, Loading and unloading the required ingredients based on the customer's requirements, Interacting with coffee machine buttons/levers and Serving the customer in a safe manner (avoiding spillage).

South Wales

Ceredigion

Team 29

Penglais School
& Aber Instruments

Automated Multi-Probe Calibrating Gantry

Team: Dan Graison
Joel Abraham
Luca Serra-Thapa
Ruadhan O'Regan

Teacher: Mark Lewis

Company link: Emma Thomas, Steffan Davies, Edward Nunn, Ramy Elaebadi and Matthew Gross

Aber Instruments have developed the FUTURA neo probe: "the world's first capacitance sensor that is designed specifically for Thermo Scientific single use bioreactors".

The probe uses the unique technology of polarising cells which provides an accurate and valuable measurement of cell density in real time.

Aber Instruments have encountered issues with manufacturing these probes. They must be produced in a clean room that involves many manual processes and working in the clean room is difficult and uncomfortable. It takes a long time to be produced. A large part of this time is consumed by the calibration process as each probe must be placed in different solutions and requires the expert handling of a technician. This process has several problems associated with it. The process is time consuming and the entire probe can malfunction if there are any imperfections in the platinum pins in the probe. As a result, only 40% of the probes pass the test.

The brief is to make the calibration procedure more rapid and involve less manual handling.

Ceredigion

Team 30

Ysgol Bro Teifi
& BTG Protherics

Electricity use reduction at the BTG Wales manufacturing site

Team: Annie Blu Evans
Benjamin Honey
Cai-Llyr Thomas
Eric Buck
Ffion Morgan
Hanna Evans
Jano Evans
Osian Dafis

Teacher: Rhun Llwyd

Company link: Peter Lake

The BTG Wales site is a biopharmaceutical manufacturing site. The site manufactures antidotes for snake envenomation and other critical conditions. The increasing cost of electricity and the associated carbon footprint provide an opportunity to improve business performance and reduce the environmental impact of the BTG Wales site. The opportunities for electricity use reduction on site are not clear, and alternatives to current approaches are not known. Electricity is used across many areas on site, including cleanroom heating, ventilation and air conditioning (HVAC), walk-in fridges and freezers, water purification, lighting and processing equipment.

The project should develop a way to measure the use of electricity across the different areas of site to determine the biggest usage areas, and then identify opportunities for reducing electricity usage based on research of available technology and improvements. The final report should show the financial and carbon impact of current electricity usage by area and provide an indication of the potential future electricity usage with a range of improvement and investments.

South Wales

Merthyr Tydfil

Team 31

The College Merthyr Tydfil 1 & Arup

LZC (Low Zero Carbon) Study on educational facilities and design an outcome

Team: Anaya Jones
Ava Fisher
Courtney Willey
Tiegan Vaughan

Teacher: Jonathan Davies, Sophie Jones, Brandon Jones, Roxanne Andrews-Pugh and Lisa Handscomb

Company link: David Emm

Ove Arup & Partners is a global firm of independent engineers, designers, planners and consultants offering a broad range of professional services. Arup employs fire, highway, acoustic and building services engineers to name a few. Arup Cardiff is based in Pierhead Street in Cardiff Bay and has over 350 employees.

The challenge this year is to investigate LZC technical options with reference to education facilities, then from this produce a design idea that can be used for educational purposes, and to prioritize reducing the overall impact on the environment. It is important to make sure that you also consider the financial cost of introducing new technologies or initiatives, and how it will impact the people who utilise your idea (both students and teachers).

You should:

1. Identify novel & new technologies available to meet energy demands.
2. Explore the implementation of that technology and the possible restraints regarding cost / construction.
3. Explore sustainable possibilities for the local ecology around the facility.

Merthyr Tydfil

Team 32

The College Merthyr Tydfil 2 & University of South Wales

Sustainable bridge design in an LEDC

Team: Alfie Long
Carl Mead
Cerys Carpenter
Ethan Griffin
Logan Evans
Olly Jones
Riley Bond
Talia Jo Lewis

Teacher: Jonathan Davies, Sophie Jones, Brandon Jones, Roxanne Andrews-Pugh and Lisa Handscomb

Company link: Shane Galvin, Heather Francis, Daniel Hedges and Joseph Crago

Due to a severe weather event, an African village has lost the river crossing which connects it to the nearest school and hospital.

The team need to design a bridge for the river crossing (approx. 15 m width) that will provide access for the village and will have resilience against future severe weather, caused by climate change. The team will need to create a model of their chosen design, that can be used at events to raise funds for the construction of the bridge.

The bridge design should consider the use of locally available construction materials, due to the poor site access. The design should consider the buildability of the bridge, given that there will be limited opportunity to employ skilled and experienced labour or sophisticated machinery. The model should be sufficiently portable to take to fund raising events.

South Wales

Merthyr Tydfil

Team 33

The College Merthyr Tydfil 3 & University of South Wales

Sustainable bridge design in an LEDC

Team: Andreas Hand
Ben Kelly
Ben Cronin
Iuene Lloyd
Josef Morris
Owen Griffiths

Teacher: Jonathan Davies, Sophie Jones, Brandon Jones, Roxanne Andrews-Pugh and Lisa Handscomb

Company link: Shane Galvin, Heather Francis, Daniel Hedges and Joseph Crago

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Monmouthshire

Team 34

Caldicot School 1 & Microchip

Storage solutions

Team: Deiniol Hughes
Jake Osmond
Kieran Howells
Ryan Bodenham
Tomos Pearce

Teacher: Mark Sheridan

Company link: Michelle Taylor and Anthony Phillips

Microchip Technology is a leading provider of smart, connected and secure embedded control solutions. Microchip Caldicot manufacture and assemble high end electronic modules for medical, robotic and emerging power industries.

The company's solutions serve more than 120,000 customers across the industrial, automotive, consumer, aerospace and defence, communications and computing markets.

The company challenged the team with a brief to investigate storage solutions and then design or propose a standardised storage solution that allows monitoring of tooling availability and usage.

South Wales

Monmouthshire

Team 35

Caldicot School 2
& Microchip

Curing solutions

Team: Alexander Turner
Charlie Price
Ethan Birch
Jay Bourne
Luke Roffey
Nia Davies
Rhys Whitty

Teacher: Mark Sheridan

Company link: Michelle Taylor
and Anthony Phillips

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The company challenged the team with a brief to investigate the current curing solutions in use at Microchip Caldicot and design or propose more efficient curing solutions aiming to reduce energy usage or to allow smarter monitoring of energy usage.

Neath Port Talbot

Team 36

St Joseph's RC School
& Sixth Form Centre 1
& Associated British Ports

Bulk Product Storage and Transport Solutions

Team: Christopher Phillips
Daniel Payne
Evie Conniff-Jenkins
Jakub Rybczak
Joshua Hill
Noah Robathan

Teacher: Samantha Williams

Company link: Nathan Evans, Olivia Quinn
and Joseph Hills

ABP are the UK's number 1 port operator, we have 21 ports in the UK, 5 of which are here in South Wales. ABP Newport have signed a lucrative new 20 year deal with a new customer, with space on the port at a premium and running out we have to find a way of storing up to 45,000 tonnes of material on the port and also transporting it to the newly built manufacturing facility.

ABP Newport - The group must study the ports lay out, taking into consideration financial and environment impacts and come up with a solution for storing and transporting & handling the volume of material the customer demands. There are a few things to consider. The equipment that we have that is capable of handling the material and its limitations. The logistical lay out of the port and the available storage solutions left. The environmental impact of handling the material, the financial cost of the solution. The group are encouraged to think outside the box and engineer a solution where possible to the problem.

South Wales

Neath Port Talbot

Team 37

St Joseph's RC School
& Sixth Form Centre 2
& Associated British Ports

Bulk Product Storage and Transport Solutions

Team: Amanda Jenkins
Brandon Hookings
Caitlin Smithers
Isabella Thorn
Madalaine Dunn
Matilda O'Leary
Mkpouto-Abasi Essien

Teacher: Samantha Williams

Company link: Nathan Evans, Olivia Quinn and Joseph Hills

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Neath Port Talbot

Team 38

Ysgol Gyfun Gymraeg Bro Dur
& Vale Europe Ltd

Alternative Source of Hydrogen

Team: Ashe Hewitt
Daniel Harries
Iwan Carter
Libby-Anne Powell
Rhydian Dazely
Taliesin Morgan

Teacher: Nerys Griffith

Company link: Peter Martin, Will Pugh and Chris Stirling

The nickel producing process needs a large amount of hydrogen, around 3000m3/h, which is currently produced using a Steam Methane Reformer (SMR) that was built in the 1960s. This uses natural gas to produce the hydrogen required but also generates a significant amount of carbon dioxide too.

Due to this, Clydach will not be able to meet its reduction in GHG unless an alternative source of hydrogen is found that will not release carbon dioxide into the environment. This means a low carbon method of hydrogen production is required that not only produces the quantity of hydrogen required (3000m3/h) but also at a cost-effective capital and operational cost. The purity of the hydrogen required is around 98%.

This project should take into account the goals of Clydach to become a zero emission site by 2050 if possible. Consideration should be given to the differences between green and blue hydrogen. The site also needs other process gases (carbon monoxide, oxygen and nitrogen) which should be taken into account when selecting a technology.

South Wales

Newport

Team 39

The John Frost School & Gilcrest Manufacturing

Fabrication and validation of a panel tensile strength testing kit

Team: Ben De-Netto
Ettehadul Haque
Finlay Davies
Jack Barton
Jake Vinh
Nayla Ali
Preston Brunnock
Ryan Oaten

Teacher: Chloe John

Company link: Stephen Griffiths and Abdallah Nasser

As a business, Gilcrest Manufacturing have been established since 1946. In the late 1990's, the company started manufacturing high-quality pharmaceutical cleanroom panels.
Gilcrest Manufacturing was formed in 2002 to focus on producing specialist and bespoke composite panels.

The Puracore product range was developed to provide a high-quality fully flush system aimed at the pharmaceutical market. This range is manufactured by Gilcrest Manufacturing. Gilcrest manufacturing continues to be a privately owned business specializing in the manufacture of composite panelling.

The task is to fabricate a tensile strength tester that can be used in the factory or on site.

Validate readings and set benchmarks for a range of the different products manufactured by Gilcrest manufacturing. Check back against a calibrated status.

Newport

Team 40

Rougemont School 1 & CAF Rail

Water Test Facility Legionella Control

Team: Ananya Majumda
Celyn Price
Frederick Seton-Anderson
Megan Price
Mia Schofield
Mohammed Ramzan
Tarig Ali
Violet Stones

Teacher: Michael Grimes

Company link: Adric Marsh and Jeffrey Peterson

As part of the manufacturing process the various seals on the trains need to be tested. Trains undergo a water test which simulates heavy rain.
A bacteria called Legionella is naturally present in all water. If left untreated, this bacteria can cause a fatal disease called Legionaires. The current method to control this is to dose the water with sodium hypochloride. The concentration of this chemical is critical; If the concentration is too low, then the bacteria will not be killed. If it is too high, then it can burn the skin of workers and damage eyesight. Currently the concentration of sodium hypochloride is manually checked every week, and additional chemical added accordingly.

The project has 2 objectives- Firstly, to explore methods to control legionella that are currently available and ensure that the existing sodium hypochloride system is still the preferred solution. Secondly, to use maths to understand precise amounts of sodium hypchloride to add to the system in order to get the optimum concentration. A preferred solution would be a software-based solution.

South Wales

Newport

Team 41

Rougemont School 2
& CAF Rail

Water Test Facility Legionella Control

Team: Anwen Wakefield
Asif Iqbal
Gruffydd Davies
Helen Lantzos
Jenny Goodreid
Jessica Sweeney
Liam Henderson
Shreya Srivastava

Teacher: Michael Grimes

Company link: Adric Marsh and Jeffrey Peterson

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Pembrokeshire

Team 42

Ysgol Bro Preseli 1
& Ore Catapult

Low Carbon Ferry

Team: Aimee Davies
Benjamin Davies
Cadi Reynolds-Cousins
Cari Davies
Emily Cowie
Lleucu Lloyd
Luke Bercury
Owain Holgate

Teacher: Duncan Richmond

Company link: Emma Lewis
and Jonathan Payman

There is a pressing need to reduce carbon emissions across all forms of transportation, as part of the government's strategy to achieve Net Zero by 2050. Current technology has the potential to eliminate harmful emissions entirely, with hydrogen technology, for example, being increasingly developed and deployed. The brief is to design a zero-emission passenger vessel for operation in Pembrokeshire and Wales.
The solution should encompass the following:

1. Exploring and identifying specific requirements for the vessel including possible routes, size, passenger numbers, range, and vessel category.

2. Systems and mechanical design of the vessel including technology selection, integration, and layout, to match identified requirements.

3. Aesthetic concept design of the vessel, to reflect an inspiring next-generation, zero-emission form of transportation.

4. Consideration and high-level design of associated support infrastructure including charging/refilling stations, docking/loading points, and fuel transportation.

South Wales

Pembrokeshire

Team 43

Ysgol Bro Preseli 2
& Aberystwyth University

Low cost and portable microscope for microplastic detection

Team: Catrin Jenkins
Dafydd Green
Daisy Whitfield
George Jones
Matthew Hill
Megan Cole
Olly Hough
Tim Chadwick

Teacher: Duncan Richmond

Company link: Tally Roberts and Dr Rachel Cross

Microplastics (MPs) are pollutants representing a global threat, and are now found nearly everywhere; marine environments, ice beds, sandy terrains, lakes, etc. Sandy beaches have drawn particular attention because they are a hotspot for accumulating MPs. MPs may vary in size, from 1um to 5mm, and their origin differs, from larger plastics which have been eroded over time, to engineer microbeads, made for applications such as cosmetics.

The device should aim at detecting and sampling small MPs of about 10-50um in size. The microplastics will have to be filtered out of the sand before analysis, the protocol will be provided. The microscope will be based on a light transmission set up, and can later be improved by adding fluorescent mode setup to discriminate the MPs from other particles.

Ideally, the group will need to design the system, using a standard Raspberry Pi camera and specifying appropriate lenses to get to the desired magnification. The project will involve designing and 3D printing a suitable housing for the optical setup(s) and the sample, with a moveable sample stage.

Rhondda Cynon Taf

Team 44

Tonyrefail Community School
& National Grid

Recovering Heat Loss from Transformers

Team: Adam Williams
Carmela Panabe
Craig Daniels
Dacio Williams
Dylan Davies
Ewan Kirby
Joel Thomas
Samantha Minty

Teacher: Rachel Hill

Company link: Nick South, Tomos Jameson and Tom Griffin

NGED has a requirement to maintain a minimum level of heating at many of its larger substation buildings which is typically provided by electric convector and storage heaters.

Also at these substations, NGED normally has a number of large power transformers which transform voltage on the Distribution Network from a higher to a lower voltage for further distribution. These transformers although very efficient do experience losses in the form of waste heat and at times of high loading need to be forced cooled with fans and oil pumps.

Therefore, there is a local source of waste heat at these substations, can this waste be used to heat the substation buildings to reduce the requirement for additional heating?

The brief includes determining the number of potential NGED substation buildings that need space heating. Estimating typical heating requirements of a standard NGED substation Control/ switch room i.e., temperature to be maintained and undertake basic heat loss calculation and investigating how heat is produced in a power transformer.

South Wales

Rhondda Cynon Taf

Team 45

Treorchy Comprehensive School & Rhondda Cynon Taf County Borough Council

Treorchy Active Travel

Team: Madison Bevan
Chloe Wall
Codi Powell
Tia Higgins
Jack Green
Regan Cooksey-Drewitt
Harri Duggan

Teacher: Owen Nelson

Company link: Roger Waters, Rachel Evans and Mohamed Hassan

The village of Treorchy has an award-winning high street which attracts visitors from surrounding communities as well as further afield. Within the vicinity there are several supermarkets, a Primary and Secondary School, Performing Arts Theatre, Industrial Estate as well as numerous shops, pubs and restaurants. The main highway route through Treorchy experiences high volumes of traffic particularly during peak times of the day. Furthermore, there is a lack of suitable active travel provision in the area which can deter users from walking or cycling. Walking and cycling has several health and economic benefits including reduced carbon emissions, less traffic congestion, healthier lifestyle and improved mental health.

The task is to develop an active travel route/ network from Dyfodwg Street to Lidl Supermarket.

There are three potential options:
1. Along the A4058
2. Along the foot path North of the Oval (past Co-operative store)
3. Alongside the railway line

Rhondda Cynon Taf

Team 46

Ysgol Gyfun Gymraeg Rhydywaun & Future Valleys Construction

Connecting the Taf Trail across the A465 dual carriageway

Team: Elisha Pope,
Lowri Williams
Rhys Davies
Ffion Williams
Ioan Smith-Hawkins

Teacher: Gareth Nash

Company link: Martin Gallimore, Alec Care and Ellie Thomas

Future Valleys Construction has been appointed to build the dualling of the A465 by the Welsh Government. The build is led by FCC a contractor based in Spain who have extensive experience of building iconic structures and new highways. Atkins, who will lead this initiative are sub-contracted to deliver the design for the contract. Atkins are a global design, engineering and project management consultant.

The Welsh Government has invested £600M to dual the A465 Heads of the Valleys road between Dowlais Top and Hirwaun, in an ambitious project to improve safety and journey times across the region.
Construction is one of the major contributors to global warming. The development of the A465 road will deliver significant benefits to the local and wider area. However the materials needed, and construction process could have a negative impact on the world if not designed and constructed in a sustainable way.

The challenge therefore is to help promote low carbon travel by designing a replacement bridge to replace the severed Taff Trail Route through Cefn Coed, near Merthyr Tydfil.

South Wales

Swansea

Team 47

Bishop Gore School
& Swansea University
- Materials Science

Enabling the Hydrogen Economy

Team: Beau Rawbone
Heather Donald
Joseph Prosser
Nora Toth-Pal
Ronan Molloy
Samuel Price
Tomiris Omaradil
Waruna Jayathilake

Teacher: Jessica Gibson

Company link: David Warren

COATED M2A sit within the Materials Engineering department at Swansea University and specialise in coatings research. The research covers a broad range of areas including decarbonisation, anti-corrosion coatings, energy storage and much more.

Hydrogen is proposed as one of the major solutions for delivering decarbonisation – being a fuel source to heat our homes and power our cars. Whilst a range of generation methods are available, the most sustainable is called Green Hydrogen whereby renewable energy is used to produce the hydrogen. The further challenge is a sustainable source of water. With 97% of the worlds water being in seas and oceans this would be the most likely source. However, sea water presents a major challenge due to its corrosive nature.

The task is to develop a cell for the production of hydrogen gas, explore how renewable energy could be used to power the cell and investigate how sea water could be successfully used within the cell.

Swansea

Team 48

Gower College Swansea – Gorseinon
& University of Wales Trinity St David
- Engineering

Smart Tanks

Team: Anna Petrusenko
Jacob Edwards
Jooyoung Jung
Katherine Lake
Keira Bater
William Throp
Anna Petrusenko
Jacob Edwards

Teacher: Ceri Davies

Company link: Dr Gregory Owen
and Jordan Jenkins

Digitalisation is having a transformative impact across a vast number of industrial sectors. Increasingly, organisations are deploying smart, digital solutions to improve operational performance, spur innovation and promote sustainable practice. In the digital age, ensuring the availability and security of process data is crucial and requires organisations to rethink the way operational technologies (OT) interact with information technologies (IT).

The process industries rely on liquid storage solutions (containing water, fuel, lubricants, or chemicals etc.) in their day-to-day operations. Monitoring the condition of liquids contained within storage vessels is essential for maintaining process continuity and safety. Traditional monitoring procedures require production operatives to manually collect samples of liquids from storage vessels for analysis, which in many instances can be time-consuming, expensive, and hazardous.

The team have been challenged to investigate the development of a “Smart Tank” solution that leverages appropriate digital technologies to enable real-time collection/monitoring of data related to the condition of stored liquids.

South Wales

Swansea

Team 49

Gowerton School
& Swansea University
- Mechanical Engineering

Printed Resistive Heaters

Team: Connor Otteson
Daniel Thomas
Dylan Hart
Ellie Beynon
Nazgol Navabi
Sonny Fletcher-Jones
Tomos Stadden
Connor Otteson

Teacher: Vicky James

Company link: Dr Sarah-Jane Potts

With ever rising energy bills and the threat of a climate crisis, many people are looking for alternative ways to heat their homes this winter. Printed resistive heaters can provide a more readily controlled, programmable and localized alternative to traditional "wet" (boiler and radiator) systems and existing electrical heating systems. Consequently, this design problem requires that you consider printed resistive heaters as an alternative method for developing an affordable, localised, form of underfloor heating for domestic use.

The team of students will need to design, prototype, and test a resistive heater rug that can be used for localised heating in domestic housing, that has the ability to be powered by sustainable energy sources. They will first need to research into existing forms of domestic heating to identify the current market, as well as existing forms of printed heaters.

A suitable electronics system will also need to be designed and made to operate the heater. This will require designing and testing out suitable circuit designs, as well as soldering together components on the final product.

Swansea

Team 50

Ysgol Gyfun Gwyr 1
& Swansea University
- Aerospace Engineering

Unmanned Aerial Vehicle with improvement of using buoyancy effect (intermittent lighter than air - aircraft)

Team: Dylan Pallett
Emily White
Ioan Osborne
Lola Burrow
Samuel Jones

Teacher: Alun Rennolf

Company link: Dr Zoran Jelic

An unmanned aerial vehicle (UAV), commonly known as a drone, is an aircraft remotely controlled from a distance and it is used in numerous roles such as observation, delivery of medicines and in disaster relief, among many.

UAVs were originally developed through the twentieth century for very niche tasks, but by the twenty-first, they had become an important part of the aviation industry, in general.

In order to increase the range, endurance and to reduce the fuel consumption this project will investigate the use of the buoyancy effect to UAV. Buoyancy has been investigated and applied in the design of aerial vehicles since the dawn of aviation – balloons, and Zeppelins, but with advancement of aircraft propulsion – aerodynes, they become obsolete as the lift generated solely by the flow over aerodynamic surfaces made aerostats too slow and bulky. However, the UAVs represent the direction in development of aircrafts where the buoyancy effect can be very useful as the size of the vehicle is small and the power resource because of the size is limited.

South Wales

Swansea

Team 51

Ysgol Gyfun Gwyr 2
& Swansea University
- Aerospace Engineering

Unmanned Aerial Vehicle with improvement of using buoyancy effect (intermittent lighter than air - aircraft)

Team: Cledwyn Mogford
Evan Kinnear
Ioan Davies
Steffan Brown
Tomos Williams

Teacher: Alun Rennolf

Company link: Dr Zoran Jelic

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Torfaen

Team 52

Coleg Gwent - Torfaen
& Meritor

Design a new drive mechanism

Team: Caitlin Hay
Charlie Avon
Dylan Viner
Georgia Mancino
Laurent Eleutherius
Ruby-June Kembrey
Samuel Lloyd
Caitlin Hay

Teacher: Patrick Seale and Sarah Hancock

Company link: Mark Norman
and Danny Ellyat-Child

Meritor currently uses an air powered ‘clockwork rig’ which simulates the wearing of both brake pads by winding bolts (tappets) away from the brake pistons at a set rate. Currently what drives the clockworks tappets away from the brake pad is a single pneumatic cylinder powered by the same air supply as the brake actuator. This is problematic and unreliable due to the large numbers of gears which makes it difficult to identify specific problem areas with the rig. The rig also uses old out of date components which are no longer manufactured by Meritor meaning that it is difficult to get replacement parts.

The task is to design a new drive mechanism which replaces the pneumatically driven system with a motor driven design. The motor should have enough torque and be able to turn in fine enough increments so that the gearing mechanism can be got rid of and the tappets driven directly. The redesign should use up to date and readily available components.

South Wales

Torfaen

Team 53

Ysgol Gyfun Gwynllyw 1
& National Museum for Wales - Big Pit

Interpreting Coal Mining Engineering at Big Pit National Coal Museum

Team: Tia Goodwin
Ava Mae Gunther
Ellis Harris
Taliah Wagg
Chase Blount
Dewi Gunning Price

Teacher: Catrin Rees

Company link: Benjamin Price
and Matthew Saunders

Big Pit is one of 7 Amgueddfa Cymru- National Museum Wales sites. It welcomes 150,000 visitors every year, including 50,000 formal learning visitors. The main attraction is the underground tour, which takes place 90m underground in the former coal mine.

The Museum's aim is to enhance visitors understanding of Science, Technology, Engineering and Mathematics (STEM) and the important role these subjects played in Wales' industrial history and our modern world.

The project brief is to research, design and construct an exciting and engaging educational model, of a particular aspect of Coal Mine Engineering, that can be used to demonstrate the importance of the STEM subjects, to educate visitors of the Museum.

Torfaen

Team 54

Ysgol Gyfun Gwynllyw 2
& National Museum for Wales - Big Pit

Interpreting Coal Mining Engineering at Big Pit National Coal Museum

Team: Harry Bowen
Cole Lewis
Demi-Leigh Jones
Jez Williams
Evie Young

Teacher: Catrin Rees

Company link: Benjamin Price
and Matthew Saunders

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South Wales

Torfaen

Team 55

Ysgol Gyfun Gwynllyw 3
& National Museum for Wales - Big Pit

Interpreting Coal Mining Engineering at Big Pit National Coal Museum

Team: Jacob Goode
Polly Green
Ruby Meredith
Connor Palmer
Evyn Saunders
James Taylor

Teacher: Catrin Rees

Company link: Benjamin Price
and Matthew Saunders

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Torfaen

Team 56

Ysgol Gyfun Gwynllyw 4
& National Museum for Wales - Big Pit

Interpreting Coal Mining Engineering at Big Pit National Coal Museum

Team: Olivia Barry
Hetty Cox
Taran Brock
Ieuan James

Teacher: Catrin Rees

Company link: Benjamin Price
and Matthew Saunders

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South Wales

Torfaen

Team 57

Ysgol Gyfun Gwynllyw 5
& National Museum for Wales - Big Pit

Interpreting Coal Mining Engineering at Big Pit National Coal Museum

Team: Mali Davies
Sage Hurter
Libby Mai Morse
Isaac Smith
Ieuan Vaughan
Mali Davies

Teacher: Catrin Rees

Company link: Benjamin Price
and Matthew Saunders

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Torfaen

Team 58

Ysgol Gyfun Gwynllyw 6
& National Museum for Wales - Big Pit

Interpreting Coal Mining Engineering at Big Pit National Coal Museum

Team: KD Bradley
Thomas Davies-Cren
Carwyn Gumm
Finlay Hawkins

Teacher: Catrin Rees

Company link: Benjamin Price
and Matthew Saunders

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South Wales

Torfaen

Team 59

Ysgol Gyfun Gwynllyw 7
& National Museum for Wales - Big Pit

Interpreting Coal Mining Engineering at Big Pit National Coal Museum

Team: Brooke Davies
Tomos Evans
Madison Hughes
Cole Jenkins
Isobel John
Ocean Morgan Hayes
Archie Morgan Hayes
Christopher Reynolds

Teacher: Catrin Rees

Company link: Benjamin Price
and Matthew Saunders

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Vale of Glamorgan

Team 60

Stanwell School 1
& University of Wales Trinity St David
- Construction & Environment

Renewable energy technologies for heat and power

Team: Cara Williams
Elliott Rabaiotti
Joshua Powell
Kimi Wong
Lara Steed
Nicholas Whalley
Robert Antonesei
Samuel Oakey

Teacher: Helen Lloyd

Company link: Lara Hopkinson

The proposed new build (approx. 360m2) will not be connected to the gas grid and will also require low carbon/ renewable energy sources for power.

The team must research potential renewable energy sources that will provide heat and power to this new building. The building will already incorporate solar energy for power, so the team will need to consider what else will be suitable for the site, given its location. The site will be heated using Air Source heat pumps. However, the site does benefit from a water source nearby.

Consider the environmental conditions of the site- what are the current weather patterns that could help inform choice of renewables? It may also be worth considering the use of energy out of hours, along with considering other suggestions to make the best use of the technologies you suggest.

South Wales

Vale of Glamorgan

Team 61

Stanwell School 2
& University of Wales Trinity St David
- Construction & Environment

Renewable energy technologies for heat and power

Team: Ahmed Saleh
Gregor Pearce
Jack Ball
Joe Price
Ted Jones

Teacher: Helen Lloyd

Company link: Lara Hopkinson

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Vale of Glamorgan

Team 62

Stanwell School 3
& University of Wales Trinity St David
- Construction & Environment

Renewable energy technologies for heat and power

Team: Alec Benyon
Arthur Luceau
Beatrice Spence
Ehan Gehlan
Finnian Lewis
Jan Kwiatkowski
Louis Carver
Miya Amari
Salma Askira

Teacher: Helen Lloyd

Company link: Lara Hopkinson

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