EMERGING ENGINEERS COMPETITION 2023

Low Carbon Footprint

Design to Power a House in 2040

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ABOUT US

The University of Western Australia (UWA)

UWA's main Crawley campus is located on the banks of the Swan River, or Derbal Yerrigan, on the land of the Whadjuk Nation. We have the immense privilege of sitting on the sacred soil where Western Australian kaartdijin, or knowledge, began. It has been a place to gather and learn for tens of thousands of years, with stories and lessons shared from generation to generation of the world's oldest continuous culture.

Our students take their learning beyond the books, at the cutting edge of knowledge creation, from passionate lecturers with real industry experience and connections.

The global impact of our research and education places us as a world top 100 university (QS 2022) with a sustained reputation for excellence across Science, Technology, Engineering and Mathematics (STEM) fields.

The UWA School of Engineering currently offers nine engineering specialisations: Automation and Robotics, Biomedical, Chemical, Civil, Electrical and Electronic, Environmental, Mechanical, Mining and Software.

OceanWorks

OceanWorks is a joint initiative between The University of Western Australia and Woodside Energy aimed at increasing research capabilities to better respond to society's current and future needs in marine science and ocean engineering. Located at the Indian Ocean Marine Research Centre at UWA, OceanWorks brings together a community of researchers to collaborate and innovate to identify solutions to some of the greatest global challenges affecting our oceans.

Girls in Engineering (GiE)

The UWA Girls in Engineering (GiE) outreach program inspires female students to explore Science, Technology, Engineering and Mathematics (STEM) study and the career pathways available in this area. Along with our industry partners, we recognise the gender imbalance in STEM fields should be addressed from an early age. We aim to challenge stereotypes, demystify fields of study and work, and work to create the engineers of the future.

Thanks to our foundation partner Rio Tinto and additional industry support from Monadelphous, Newmont, and Newcrest, the program has reached over 15,000 students in Years 2-12 since 2014.

COMPETITION OVERVIEW

PARTICIPATION

The Emerging Engineers Competition is a 20-week competition which sees students work on a project in small teams (at school or home), to design a solution in response to the project theme.

The competition is open to students currently enrolled in Years 2-10 in schools across Western Australia or in equivalent studies in a home-school group that is registered with Department of Education in Western Australia.

Students must register in a team of 3-5 (maximum of 5 students per team). Teams may include students from mixed years. As a team, students are required to develop a design solution for the competition theme outlined on page 6.

Please see page 7 for information on the teacher and student registration process.

COMPETITION OBJECTIVES

The Emerging Engineers Competition introduces engineering research and development in a real-world context. Students will follow the engineering design process and design criteria to research, develop and pitch an innovative solution.

This year's theme is an open challenge in engineering design, that encompass a number of specialisations including civil; electrical and electronic; and environmental engineering.

In addition, the competition provides opportunity for students to demonstrate transferable skills such as:

- Critical and creative thinking
- Communication
- Independent research
- Project management
- Teamwork

COMPEITION THEME & TIMELINE

Low Carbon Footprint Design to Power a House in 2040.

In 2023, the competition theme is to innovate a solution for a low carbon footprint design to power a house in 2040. This theme focuses on examining what our current energy demands are and how we meet them, and asks students to propose cost effective and sustainable ways to meet what our energy needs may be in 2040.

Fossil fuels are currently burned to generate power, resulting in large concentrations of CO_2 being released into the atmosphere. Along with contributing to the climate crisis and global heating, fossil fuels are a finite resource. Renewable energy is an expanding industry with around 30% of the world using renewables to generate electricity.

Thinking beyond where we might source our energy, research into the types of housing we may have in the future is also being undertaken. For example, reducing the area housing occupies may lessen environmental impacts. 'Tiny homes' or expanding housing upwards rather than outwards are examples of current solutions. However, this raises the issue of how to optimise powering smaller homes and large apartments.

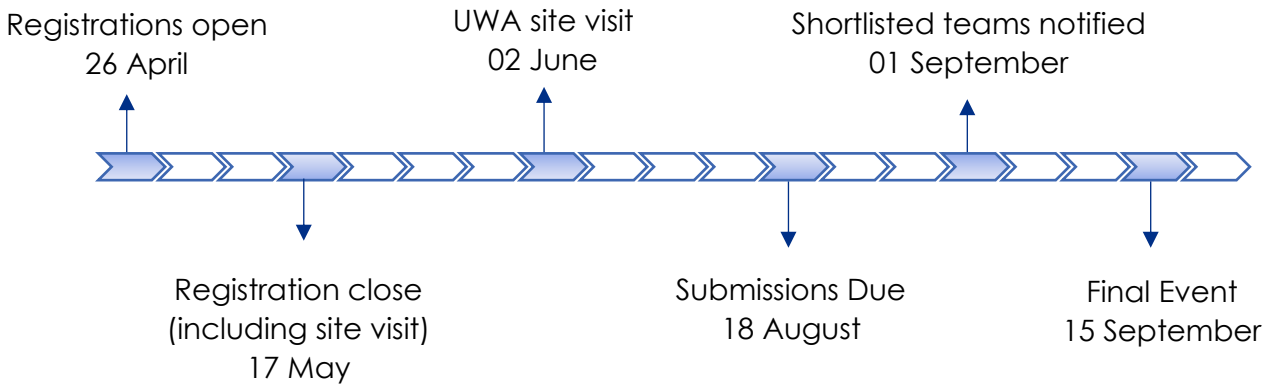
What does a low carbon house in 2040 look like?

TIMELINE

The competition begins with an on-campus site visit at UWA, **Friday, 2 June 2023**. This full-day event is an opportunity for students to gain a deeper understanding of the theme, meet experts from OceanWorks and UWA's School of Engineering and ask questions before beginning their research.

The competition takes place over Term 2 and Term 3 2023 with the final submission due **5pm AWST Friday, 18 August 2023**.

All schools will be notified of the outcome of their first submission by **Friday, 1 September 2023.** Shortlisted teams will be invited back onto campus to present their solution to a panel of judges at the Final Event, on **Friday, 15 September 2023.**



TEACHER & STUDENT REGISTRTION

Teacher, student and UWA site visit registrations close 5pm AWST, Wednesday 17 May 2023

Throughout the competition, students must be supervised by a registered teacher from their school. This teacher will be the main point of contact for all correspondence from UWA during the competition. In the event that two groups are participating from one school, please nominate only one teacher as the primary contact and supervisor.

Female or non-binary students currently enrolled in Years 2 – 10 or in equivalent registered home-school can register in teams of 3 to 5 students.

A maximum of **two groups** (10 students) can be registered per school.

Students must have a signed permission form to participate in the competition. The nominated teacher is responsible for forwarding signed permission forms before registration closes.

Supervising teachers to register their details here.

UWA Crawley site visit

The competition includes a site visit to UWA Crawley campus. Although not compulsory, the visit is a great opportunity for participants to gain a greater understanding of the competition theme ahead of their own research and design.

To register attendance to the site visit, supervising teachers must complete your school's registration form and return it to the competition organisers at to emergingengineers@uwa.edu.au by **5pm AWST Wednesday, 17 May 2023.** This form can be obtained by e-mailing competition organisers at to emergingengineers@uwa.edu.au

Students attending the site visit must also have returned their permission forms to the competition organisers via their supervising teacher by 5pm AWST Wednesday, 17 May 2023.

SUBMISSION GUIDELINES

Project Submission due 5pm AWST, Friday 18 August 2023.

Projects must be submitted digitally via email to emergingengineers@uwa.edu.au

The format of this submission required all documents (e.g. research reports, PowerPoint slides, links to websites and short videos) attached in **one e-mail**. All work submitted needs to be clearly labelled, And using an appropriate email subject. Annotated images of prototypes developed are also encouraged, but not compulsory.

Please note this is an open design competition, where students have autonomy over the medium used to communicate their ideas. Teams are welcome, but not required, to build a prototype or model. Shortlisted teams are invited to bring any prototypes, models or displays to the Final Event.

Regardless of submission format, competitors will be judged on the quality of their research, the innovation of their design and the engineering process.

Please see page 13 for further information on the submission guidelines.

Final Event, Friday 15 September 2023.

Shortlisted teams will be invited to present their project at the Final Event.

At the Final Event all student work and presentations must be saved to a USB or external hard drive and be compatible with Windows operating systems.

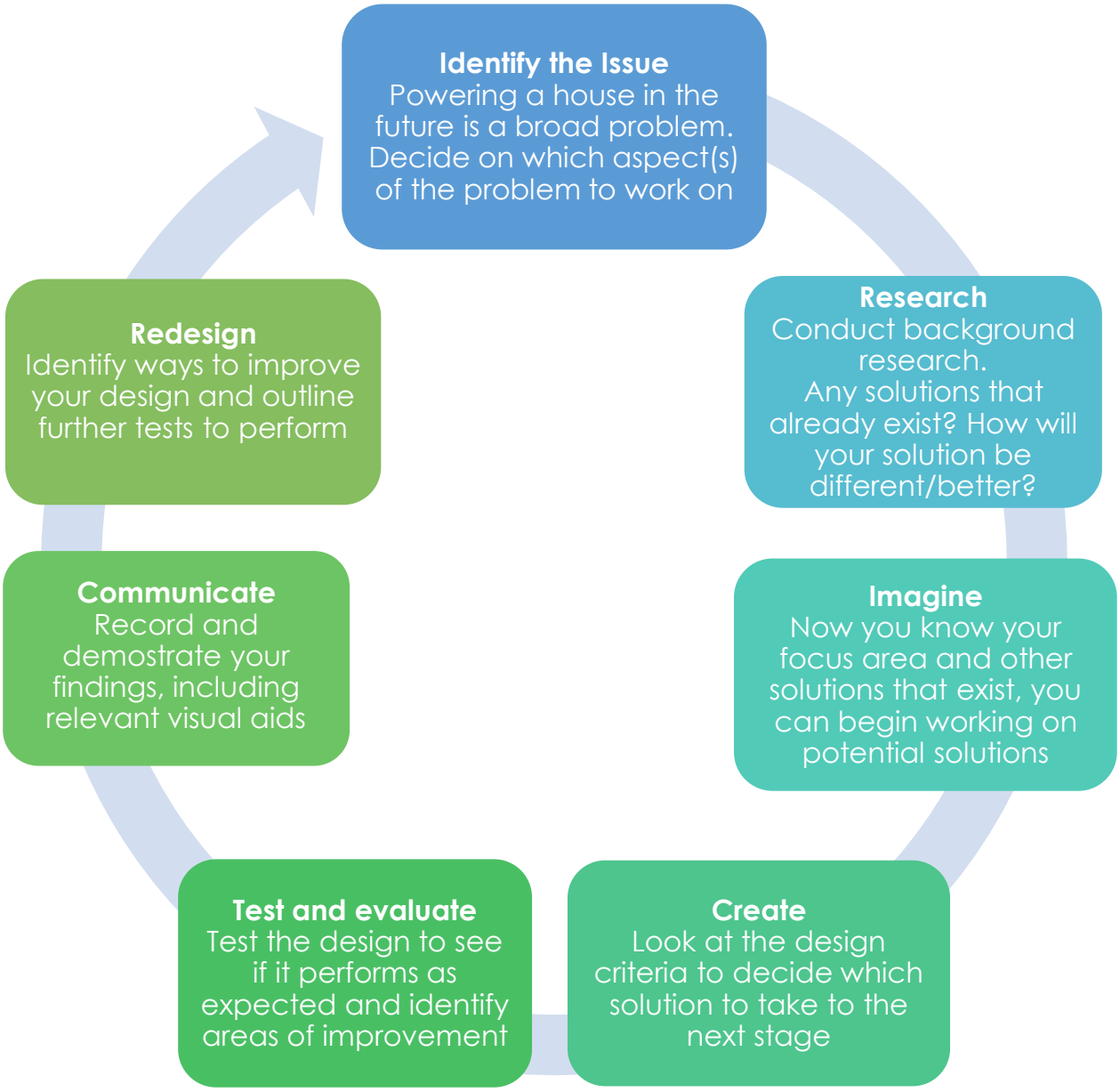
Teams must be prepared to present **'offline'** without relying on internet access for their final presentation. UWA will **not** provide wifi access to any students or teachers at the Final Event.

The panel of judges will be made up of UWA and industry experts. Further details surrounding the Final Event will be shared with supervising teachers of shortlisted teams on Friday 01 September 2023.

ENGINEERING DESIGN PROCESS

Teams are expected to follow the Engineering Design Process in the development of their design solution. The design process is cyclical in nature. It is a continual process as engineers strive to constantly improve the solutions that we have.

The judges are not only looking for the 'best' solution; they will also be looking for evidence that the team has followed the engineering design process.



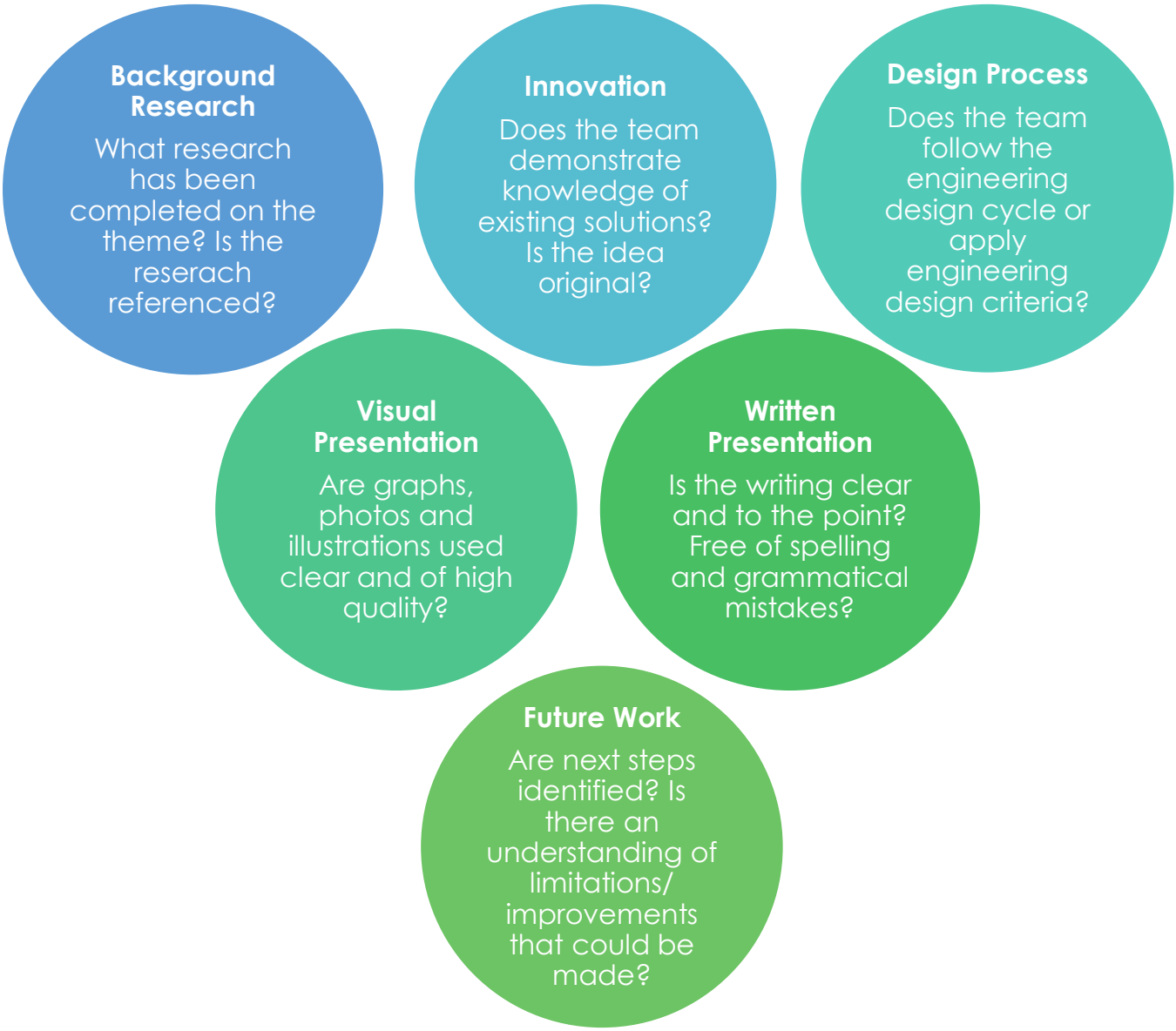
DESIGN CRITERIA

Consider each of the design criteria below for each potential solution you have come up with. These criteria can be used when deciding which is the best possible solution to create and test. While the judges will not explicitly assess these criteria, it is expected that it will be embedded in your team's research and design.

JUDGING CRITERIA

The diagram below highlights key criteria that judges will use to shortlist teams following the first submission. Students are encouraged to refer to these criteria throughout their research and design to be reflected in their final work.

A detailed breakdown of the judging criteria for the first submission is provided in Appendix I.



BACKGROUND RESEARCH

Conducting high quality research is the key to success in this competition. The judges will be looking for evidence that the team has conducted their own independent research beyond the information provided in this manual, drawing on credible sources to develop their innovative solutions.

We recommend students source credible research via online databases such as:

Directory of Open Access Journals: https://doaj.org/

PLoS One: https://journals.plos.org/plosone/

State Library of Western Australia: https://slwa.wa.gov.au/

Trove: https://trove.nla.gov.au/

Links to some articles students might be interested in, to give them an introduction to the theme have also been provided.

1. https://www.watoday.com.au/national/western-australia/perth-s-sweatiest-postcodes-how-are-we-going-to-cool-down-our-suburbs-20220224-p59zdl.html
2. https://www.abc.net.au/news/2023-03-11/perth-housing-developments-that-could-improve-tree-canopy/102060214

REFERENCING

It is expected that students will provide a list of references that is formatted according to a referencing style of their choice. For example, The University of Western Australia uses Harvard referencing style.

Examples of Harvard referencing of the pervious links are provided below.

1. Logan, Tyne. 2023. The 'tree house' design that could lead to more greenery in Australia's drying suburbs. [online] Available at: <https://www.abc.net.au/news/2023-03-11/perth-housing-developments-that-could-improve-tree-canopy/102060214>
2. Brooks, Sarah. 2022. Perth's sweatiest postcodes: How are we going to cool down our suburbs. [online] Available at: <https://www.watoday.com.au/national/western-australia/perth-s-sweatiest-postcodes-how-are-we-going-to-cool-down-our-suburbs-20220224-p59zdl.html>

DESIGN SUBMISSION GUIDELINES

The final design must be submitted digitally via email to emergingengineers@uwa.edu.au

This is an open design competition, where students have autonomy over the medium used to communicate their solution. Teams are welcome to, but not required, to build/ submit a prototype.

Whichever format is chosen, it is expected that the submissions will include the following content:

Theme Explanation

- Describe which aspect of the issue you are focusing on in your solution
- Explain what the issue is
- Review current solutions to this problem
- Define the scope of your project

Design Description

- Describe the application of your solution and how it works
- Reference any diagrams or photos to support
- Describe your use of the Engineering Design Process

Evaluation

- Assess your team's performance
- Critically reflect on your design and include evidence
- Summarise the strengths and weaknesses of your design
- Identify next steps

APPENDIX I: 2023 Emerging Engineers Competition, Submission One Judging Criteria

Criteria	Not demonstrated 0-2	Developing 3-4	Satisfactory 5-6	Above standard 7-8	Excellent 9-10
Background research 20%	Students have found a few credible sources. Information presented is somewhat accurate.	Students have found an average number of credible sources. Information is accurate and relevant.	Evidence of independent research is presented. Multiple and varied credible sources used. Information is accurate and relevant.	High standard of independent research has been presented. Multiple and varied credible sources. Information is accurate and relevant.	Very high standard of research has been presented. Sources are credible and comprehensive. Current research/ experts are drawn on.
Innovation 20%	Limited attempt to review current solutions. Design presented shows some originality or small degree of improving existing solutions.	Some analysis to review current solutions. Design presented contains original elements or shows improvement on existing solutions.	Good analysis of existing solutions. Design presented contains original elements or shows good improvement on existing solutions.	In-depth analysis of existing solutions. Design presented is highly original or shows significant improvement on existing solutions.	In-depth and comprehensive analysis of existing solutions. Design presented is original or shows outstanding improvement on existing solutions.
Design process 25%	Limited attempt to follow design process. Limited attempt to use engineering design criteria.	Some aspects of the design process have been followed with some attempt to use engineering design criteria.	Design process has been followed well and group has considered use of the engineering design criteria	Design process has been followed very well. Team has considered and applied the engineering design criteria	Design process has been followed accurately and the team has, in detail, applied this to the engineering design criteria.
Future Work 20%	Team has made none to small attempts to identify limitations of their own design.	Team has stated some limitations of their own design with some attempt to link these to future steps.	Team has explained some limitations of their own design and stated how these are linked to future steps.	Team has identified and exampled a number of limitations to their design and has linked these to future steps.	Team has identified and explained several limitations of their design and have applied this to future steps.
Presentation 15%	Limited use of visual aids to support research. Written report is unstructured with spelling and grammar errors.	Adequate use of visual aids to illustrate research. Writing is mostly clear and structured with some errors.	Clear visual aids used to enhance any written report, which is clear and concise. Few spelling and grammar errors.	High quality visual aids used to support written material, which is clear, structured, and concise, with no errors.	High quality visual aids supporting explanation to written material, which is clear, well-structured and with no errors.