Young
Engineers
AustraliaNational Case
Competition
2021





1. Table of Contents

2. About Engineers Australia		
3. About Young Engineers Australia	B	
4. Case Competitions	1	
4.1 What are they? \checkmark	1	
4.2 How do I prepare?	1	
4.2.1 Frameworks to help \angle	1	
4.2.2 Frequently asked questions	$\overline{)}$	
5. Competition Rules	6	
5.1 Eligibility criteria	6	
5.2 Team participation	6	
5.3 Registration fee	6	
5.4 Prize	6	
5.5 Team re-arrangements	7	
5.6 General requirements	7	
6. Case Study Brief	В	
6.1 Problem statement	В	
6.2 Specific design requirements10		
6.3 Background Information1	1	
6.3.1 What is CCUS and how does it work?	1	
6.3.2 Tackling emissions from existing energy assets 12	2	
6.3.3 Removing carbon from the atmosphere	3	
6.3.4 The role of CO2 use1	4	
6.3.5 Barriers to entry12	1	
6.3.6 Strengthening Australia's climate commitments15	D	
7. Submission details	6	
7.1 The completion timeline16	6	
7.2 Stage 1: Proposal phase 16	6	
7.3 Stage 2: Final Presentation Stage (Top 5) 1^{-7}	7	
8. Stay connected		
9. Terms and conditions	9	
	2	



2. About Engineers Australia

Engineers Australia is the largest and most diverse body of engineers in Australia. As Australia's principal engineering association, we serve and represent around 100,000 professionals at every level, across all fields of practice. We are committed to advancing engineering and the professional development of our members. We are the trusted authority of a profession that shapes the lives of every Australian. With countless organisations, institutions and government agencies relying on our expertise to create, accredit and assess engineering programs and practitioners, our proven dedication to engineers and the Australian industry is unparalleled. With a rich history and awards programs to highlight the dedication and accomplishments of engineers, we have created a legacy for all to take part in. And with diverse groups and thousands of events each year, we have created a unified forum for engineers like no other.

3. About Young Engineers Australia

We are the voice for young engineers and student engineers within Engineers Australia. We are committed to facilitating the academic, personal and professional development of our members. This includes easing your transition from student to professional young engineer.

Young Engineers Australia is a community of students, associates, technologists, graduates and professionals from all engineering disciplines. Young Engineers Australia organises various activities for its members including panel discussions, seminars on topics relevant to young engineers, social events to network with fellow young engineers and industry professionals, and CPD events for young engineers on the pathway to Chartered Engineer status.

YEA membership is free for students and provides the following benefits:

- Recognition among peers and colleagues
- Ongoing professional development and mentoring
- Networking opportunities and industry links
- Career management resources
- Development of leadership and management skills
- Joint events with other industry sectors
- Technical seminars and social activities
- Monthly events offering CPD points
- Member event discounts
- Volunteering opportunities
- Access to Engineers Australia's resources for students and graduates.



4. Case Competitions

4.1 What are they?

A case competition is a fast-paced simulation of a real-world project. Multidisciplinary teams work collaboratively on a problem to provide a set of deliverables within a short timeframe. Utilising their theoretical knowledge, students gain first-hand experience to develop their critical thinking, build new skill sets, push themselves out of their comfort space and even create lasting friendships along the way.

4.2 How do I prepare?

The general approach to any case competition is to:

- Research the topic.
- Brainstorm and whiteboard.
- Consolidate the proposed recommendation.
- Succinctly prepare documentation in accordance with the required structure in section 7.2.

4.2.1 Frameworks to help

The following are suggestions of frameworks that could be useful as you brainstorm with your team members during the ideation phase. It is not a necessity for students to apply these frameworks and they will not be used as a judging criterion.

- MECE Principle Mutually Exclusive and Collectively Exhaustive
- Porter's 5 forces
- Six Thinking Hats
- Hypothesis Driven Approach
- Problem Logic Trees
- Customer Journey Mapping
- The 5 Whys
- Gap Analysis.



4.2.2 Frequently asked questions

If you want to learn more about case competitions, please watch our video <u>here</u>. It contains a collection of frequently asked questions answered by a panel of case competition experts.

Questions include:

- What is a case competition?
- Why should an engineer participate in one?
- Can you give us an introduction to your experiences with case competitions?
- What is the time commitment like? How long do they run?
- How do you find case competitions? When are they on?
- What's the best approach to forming a team?
- How do you prepare for a case competition?
- What's the most interesting case competition you've worked on?
- Do you have a particular strategy in problem-solving?
- What's the best way to network with the judging panel?
- What metrics are you being judged on?
- What are your top tips to deliver a great pitch?
- Have you always been a confident public speaker?
- What doors have opened for you through your participation?



5. Competition Rules

This competition will be held in two phases:

Phase 1: Proposal Submission

The Top 10 Teams will be announced and recognised nationally

Phase 2: Finalist Presentation (Top 5 teams)

5.1 Eligibility criteria

The competition is open to all student engineers (both undergraduate and masters) currently enrolled in any university in Australia. Exchange students currently overseas can still participate in this case competition.

You do not need to be a member of Engineers Australia, but we strongly recommend becoming a student member - it's free!

5.2 Team participation

Teams of three to four student engineers will need to be formed, and sign-up with their team name - We encourage teams to be formed from a mix of engineering disciplines as the case is multidisciplinary.

Formation of teams as pairs or individuals are not permitted.

5.3 Registration fee

Entry to the competition is free.



5.4 Prize

1st place Team (National Winner):

- \$1,500 in gift cards as a team prize;
- Virtual tickets for each team member to the <u>Climate Smart Engineering</u> Conference (valued at \$400 each)
- Opportunity to present your submission during the conference.

2nd place Team:

• \$500 in gift cards as a team prize

All teams that submit their proposal will receive a certificate of acknowledgment from Engineers Australia!

The Top 10 Teams will be announced and recognised nationally.

5.5 Team re-arrangements

Sometimes life pulls team members in other directions. If your team happens to reduce from 4 to 3 members, you are still able to compete as a team, but please email us.

Please note, the competition organisers are not responsible for resolving disagreements between teams. Just as in real life, the success of your team is the responsibility of each team member.

5.6 General requirements

Contacting industry specialists is strictly not permitted.

Plagiarism is strictly not permitted.

You may ask questions about the case study brief or the submission format up until 5pm on 2 September. Please note, for transparency and fairness, both your question and the answer will be shared with all teams - so be careful about disclosing your design ideas in your question!



6. Case Study Brief

6.1 Problem statement

As a key part of Australia's transition to clean energy and carbon neutrality, **Engineers Australia** is seeking innovative ideas for the **utilisation** of captured carbon.

Carbon sequestration involves capturing carbon dioxide produced by burning fossil fuels and storing it safely away from the atmosphere. Utilisation of this carbon can then make a process carbon-negative, which fixes this carbon in a carbon sink: Carbon capture, utilisation and storage (CCUS).



Figure 1: Carbon Capture, Utilisation & Storage (CCUS) process (IEA, 2020)



In utilising the captured carbon, the strategic directions for the idea are to:

- Reduce CO2 from the atmosphere, and balance unavoidable emissions.
- Foster existing, pilot, and pre-commercial CCUS facilities to share a strategic value in building a network that enables a reduction in costs and risk on a large-scale.
- Contribute to the transition of emission reduction, and potentially enable a least-cost platform for low-carbon hydrogen production.

Your team's task is to propose a solution that answers four key questions:

1. What is your solution to utilise captured carbon?

2. How will the utilisation of carbon impact the lifecycle footprint of where it is applied?



• Pick one stage of the lifecycle to focus on

Raw material extraction - Production/ processing systems

Manufacturing - Industrial processes to convert raw material into the product Distribution - Packaging and transportation through the market Use - Operational component of the product/ service by the consumer Disposal/ recycling - Potentially reused or recycled for different applications.



3. What sustainable development goals does your solution aim to incorporate?

• More about the sustainable development goals here: <u>https://sdgs.un.org/goals</u>

4. How will you promote responsible sourcing of resources throughout the supply chain?

- Educational/ marketing resources/ community initiatives
- Raising Capital/Partnerships with carbon emitting businesses? (Carbon Credits)
- Sustainability Victoria, EUA (payback costs), Energy efficient certificates e.g. VEEC

Ideally, your design solution will find a way to interconnect all these areas.

Your solution will also need to meet the strategic direction of Australia's Climate Change Action Strategy (2020 - 2025).

6.2 Specific design requirements

From the idea, the following three requests MUST be considered:

1. Specify the **global** location (including industry) and the source of carbon (e.g Power plant, manufacturing facility etc.).

2. Estimate the quantifiable amount of carbon that is obtainable for capture, and then utilised in the process.

3. Comment on the feasibility of the proposal (see 6.3 Background Information below).



6.3 Background Information

6.3.1 What is CCUS and how does it work?

Carbon capture, utilisation and storage (CCUS) incorporates capturing carbon dioxide (CO2) generated from large point sources, such as power generation or industrial facilities, and in turn, averts it from being released into the atmosphere. The techniques for capturing CO2 include liquid absorption, pressure swing adsorption, membrane separation, and cryogenic separation.

Carbon Capture:

The CO2 is separated from the other gases produced in industrial processes.

Utilisation:

The captured CO2 is re-used as an input or feedstock to create products or services.

Storage:

The CO2 is injected into deep underground rock formations for permanent storage.

Traditionally, captured CO2 has been injected into carefully selected, deep geological rock formations, where it is permanently stored (CCS). Another recently investigated solution is the utilization of the captured carbon dioxide as a feedstock to other processes (CCU). The aim of this is to create processes that result in a carbon-neutral footprint, to offset the industrial and fossil fuel emissions. Applications for using carbon dioxide as a feedstock range from chemicals to liquid fuels. Figure 2 below shows the possible pathways that can be taken for the utilization of carbon emissions.



Figure 2: Pathways of carbon storage and utilization (Kilisek, 2015)



6.3.2 Tackling emissions from existing energy assets

To better transition into clean energy, CCUS technologies can provide a method of offsetting emissions from existing sectors, where reaching a state of zero emissions may not be economically feasible. While alternatively, adaptation of the technology can be used to retire existing power plants or repurpose them at lower operational rates of capacity. In the power sector, this can diversify options, when it comes to energy generation, and also minimise per capita emission generating assets.



Figure 3: Yallourn coal-fired power station in regional Victoria (Energy Australia, 2021)



6.3.3 Removing carbon from the atmosphere

Approaching net-zero emissions will require a form of carbon removal, which coincides with multiple approaches - Nature-based solutions such as afforestation and reforestation, involves new planting or adding trees in an area that has not been previously forested. While enhanced natural processes, such as incorporating biochar, involve adding charcoal produced from biomass into soils.



Figure 4: Process of Afforestation and Reforestation (Revi et al., 2008)

Whereas technology-based carbon removal solutions such as BECCS (extracting bioenergy from biomass to capture carbon) and DACS (capturing carbon dioxide directly from ambient air) are dependent on CCUS.



Figure 5: Process of Bioenergy with Carbon Capture and Storage (BECCS) (Revi et al., 2008)



6.3.4 The role of CO₂ use

In the modern age carbon use is not going away anytime soon. It is up to engineers to devise sustainable ways of utilising carbon dioxide and start up new ways of utilising this abundant resource. A quick summary of existing uses of CO2 are: Promoting the growth of vegetation from greenhouses to forests, food and carbonated beverages, manufacturing of chemicals and materials organic chemistry and minerals, Manufacturing of plastics, and Liquid fuels "Synthetic designer fuels".



Figure 6: Examples of products made from CO2 (CO2 Sciences, 2016)

6.3.5 Barriers to entry

There are a few notable barriers that new technologies must overcome before they become the norm. Although there are many great ideas, many of them are simply not able to be scaled effectively, due to cost and lack of investment or other restraints. Similarly, for new technology to be widely adopted, the installation measures needed to implement the technology should be feasible. Of course, the new technology needs to be effective and align with policy, social views, and keep the safety of its users.

14



6.3.6 Strengthening Australia's climate commitments

Historically Australia has been globally criticized for their poor uptake in climate change technologies and in particular, the overall partiality for fossil fuels. There are however new opportunities for Australia to become a global player in future climate technologies. The Federal Government has announced a \$3.5 Billion investment to deliver on Australia's 2030 Paris Agreement commitments of which \$539.2 Million has been allocated for hydrogen and carbon dioxide capture utilisation and storage (CCUS). As one of the priority technologies in Australia's Tech-nology Investments Roadmap, CCUS technologies are the only large-scale mitiga-tion option that can deliver the additional CO2 emissions reductions to meet our climate goals by 2050. (Australia's climate change strategies, 2021)



Figure 7: Australian initiatives on climate change (Briggs & Philip, 2019)



7. Submission details

7.1 The completion timeline

The following are the key dates of the competition timeline:

- Team registration opens: 16 August 2021
- Information Webinar: 25 August 2021
- Team registration closes: 27 August 2021 at 5:00pm (AEST)
- Case study release: 28 August 2021 at 12:00pm (AEST)
- FAQ Webinar: 31 August 2021
- Case study Q&A deadline: 02 September 2021
- Proposal submission closes: 10 September 2021 at 11:59pm (AEST)
- Announcement of Top 10 teams (including Top 5 finalists): 23 September 2021
- Final virtual pitch-off (Top 5 finalists): 30 September 2021
- National Case Competition winners announced: 30 September 2021

7.2 Stage 1: Proposal phase

It is noted that only ONE submission is required per team. In the event of multiple submissions, your last submission prior to the deadline will be the submission assessed.

Teams are required to adhere to the following instructions:

1. The naming convention of your proposal documentation is to be:

• Team Name_Proposal_YYYY.MM.DD

2. Format of the proposal is to be as follows:

- PDF format
- A cover sheet including your team name, names of team members, and the universities you are enrolled in.
- The submission is limited to a maximum of three A4 pages (single-sided), and one A3 page (single-sided). The cover page, bibliography/references and appendices **are not** included in this page limit.

3. Please submit your proposal to <u>yeaevents@engineersaustralia.org.au</u> by **11:59pm (AEST) on 10 September 2021** in the naming convention as stipulated in Section 7.2 (1).



7.3 Stage 2: Final Presentation Stage (Top 5)

Following the proposal submissions, the top five teams will be selected and will virtually present to our panel of judges. We will throw in an additional curveball question that must be answered by the top five teams in their final presentation.

All teams will be informed on both social media and by email of the results on 23 September 2021.

The finalists round presentations will take place between 5.30pm - 7.30pm (AEST) on Thursday, 30 September 2021.

The finalists round presentation must adhere to the following structure:

1. 10-15 page PowerPoint presentation. You are allowed to submit the slide deck in either PowerPoint or PDF format.

2. Each team's presentation time will last 15 minutes.

- Your team will have 10 minutes to present your solution
- This will be followed by 5 minutes of questions from the judging panel

3. Please submit your slide deck to <u>yeaevents@engineersaustralia.org.au</u> by **11:59pm (AEST) on 29 September 2021.** The naming convention of your slide deck is to be: '*TeamName_Presentation_YYYY.MM.DD*'.

While it is strongly encouraged that each team member presents, it is not strictly necessary.

The announcement of the national winning team will be made on the day itself following the virtual presentations.

Winners will be contacted directly by Engineers Australia after the event to arrange distribution of prizes.





8. Stay connected

Young Engineers Australia Case Competition event page.

Young Engineers Australia LinkedIn Page (<u>https://www.linkedin.com/</u>groups/4668397/)

Young Engineers Australia Facebook Page

The Engineers Australia student Facebook communities per state can be found here:

- Engineers Australia NSW Student Members
- Engineers Australia QLD Student Members
- Engineers Australia SA Student Members
- Engineers Australia VIC Student Members
- Engineers Australia WA Student Members

For any concerns or queries regarding the case competition, please email us at yeaevents@engineersaustralia.org.au and we will do our best to get back to you. Please note that you will receive replies to your emails from either:

- yeaevents@engineersaustralia.org.au (Engineers Australia staff) or,
- <u>yeacasecomp@gmail.com</u> (Young Engineers Australia committees and volunteers)

Best of luck and most importantly, have fun! It's all about the learning experience.





9. Terms and conditions

These Terms and Conditions set out the terms of participation in the YEA Case Competition 2021 (the "Competition").

- 1. The promoter of the Competition is The Institution of Engineers Australia trading as Engineers Australia ("Engineers Australia") (ABN 63 020 415 510), Engineering House, 11 National Circuit, Barton, ACT, Australia, Telephone No: 02 6270 6555.
- 2. The Competition is a competition in which teams of three or four (multi-disciplinary) student engineers work together to come up with a solution to a proposed project. It is designed to be a fast-paced simulation of real-world problem solving condensed into a set timeframe.
- 3. Entry to the Competition is free and open to all student engineers currently enrolled in a university in Australia only and who meet the criteria on the promotion material. An entrant must be an individual. Organisations (including bodies corporate) are ineligible to enter. Individual entrants under 18 years of age must have the consent of their parent or guardian to enter the Competition. Employees of Engineers Australia, their immediate family members, employees of any company associated with Engineers Australia, any person associated with the Competition, and any individual associated with the provision of the prize(s), are not eligible to enter.
- 4. Each entry must be entered in accordance with these Terms and Conditions. By entering the Competition, each entrant agrees to be bound by these Terms and Conditions. Engineers Australia may in its discretion refuse to award any prize to any entrant who fails to comply with these Terms and Conditions. All relevant instructions (if any) on the Engineers Australia website (www.engineersaustralia.org.au) form part of these Terms and Conditions.
- 5. The information, material, and assumptions provided in the case study brief have been prepared by the Young Engineers Australia committee, in conjunction with Engineers Australia. All information has been sourced publicly and is to be used only in connection with the YEA Case Competition 2021. Distribution of this material may be used only by participants of this competition and/or the judging panellists during the duration of this competition.
- 6. The Competition opens at 12:00pm on Saturday, 28th August 2021 and closes at 11:59pm on Friday, 10th September 2021. ("Competition Period"). Any entry received after the expiry of the Competition Period will be deemed invalid. No responsibility is accepted for late, lost, delayed or misdirected entries.
- 7. To enter the Competition, you must:
 - **a.** Register your interest to participate no later than 05.00pm on Friday, 27th August 2021 (maximum number of members per team is four);



- **b.** Submit final proposal for review and judging no later than 11:59pm on Friday, 10th September 2021; and
- **c.** Be available to attend the final presentation webinar on Thursday, 30th September 2021, should your submitted proposal be selected as a finalist.
- 8. By participating in this case competition, you agree that the Young Engineers Australia Committee can share your submitted proposal with CSE - Climate Smart Engineering Conference team, at their discretion.
- 9. The total prize pool value is \$2000 (voucher or gift card) to be won. The Prizes are:

First Place	Second Place
- \$1,500 in gift cards as a team prize;	- \$500 in gift cards as a team prize.
- Virtual tickets for each team member to the Climate	
Smart Engineering Conference (valued at \$400 each)	
plus the opportunity to present your submission	
during the conference.	

- 10. Each prize must be taken as is and no compensation will be payable if a winner is unable to use the prize as stated. It is a condition of accepting a prize that the winner accept the conditions of use of that prize.
- 11. If a prize (or part of the prize) is unavailable, Engineers Australia, in its discretion, reserves the right to substitute the prize (or that part of the prize) with a prize to the equal value and/or specification, subject to any written directions from a regulatory authority.
- 12. The winning team will be selected by a panel of judges, based on the pitch and presentation of their submitted proposal. The winning team will be announced at the conclusion of the presentation webinar scheduled for Thursday, 30th September 2021. The decision of the panel of judges in regard to the winning team will be final and will be binding on each person who enters the Competition, and no correspondence will be entered into.
- 13. Prize winners will be notified at the conclusion of the presentation webinar on Thursday, 30th September 2021. Prizes will either be given in person to the winning team members (only if possible due to current Covid-19 restrictions) or be forwarded to winning team members at the postal address provided to Engineers Australia in this Competition within 28 days after the close of the Competition.
- 14. Prize winners' names will be published on Engineers Australia Facebook pages on Friday, 1st October 2021.



- 15. By entering the Competition, entrants consent to Engineers Australia using their personal details they provide in connection with the Competition for purposes of promoting the Competition, facilitating the conduct of the Competition and the award of any prizes. Entrants' personal information provided in connection with the Competition will be handled in accordance with the Engineers Australia Privacy Policy available on the Engineers Australia website www.engineersaustralia.org.au.
- 16. If there is any event that prevents or hinders Engineers Australia's conduct of the Competition or Engineers Australia's ability to deliver the prize/s to the prize winner/s of the Competition, or if the winner/s has not claimed the prize/s within 3 months of the prize being drawn, Engineers Australia may, in its discretion, cancel the Competition and recommence it at another time under the same conditions, or randomly select another winner.
- 17. Engineers Australia is not responsible for any incorrect or inaccurate information, or for any of the equipment or programming associated with or utilised in this Competition, or for any technical error that may occur in the course of the administration of this Competition. Engineers Australia assumes no responsibility for any error, omission, interruption, deletion, defect, delay in operation or transmission, communications line failure, theft or destruction or unauthorised access to or alteration of entries.
- 18. To the full extent permitted by law, by entering this Competition, the entrant agrees that Engineers Australia will not be liable for any injury, damages, expenses, or loss whatsoever (whether direct or indirect) to persons or property as a result of any person entering into the Competition or accepting or using any prize, including without limitation non-receipt of any prize or damage to any prize in transit. This release extends to any injury, damage, expenses or loss whatsoever (whether direct) to persons or property arising from the Competition being run on any form of social media including, but not limited to Facebook.
- 19. This Competition is in no way sponsored, endorsed or administered by, or associated with, any social media network.





10. References

For more information, please refer to the following links:

- https://www.dfat.gov.au/sites/default/files/climate-change-action-strategy.pdf
- <u>https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/futures-reports/co2-utilisation-roadmap</u>

