Nuclear engineering

with Dr Austin Lo

Talking *points*

Knowledge

1. What is thermionic energy conversion (TEC)?
2. What is nuclear radiation?

Comprehension

3. What is the space-charge effect and how is it counteracted in SPACE-TEC?
4. What are the efficiency limitations of traditional TEC designs, and how does SPACE-TEC overcome these limitations?

Application

5. Foams – solids or liquids with an exceptionally high surface area due to gas bubbles within them – are highly useful in many sectors and industries. Other than SPACE-TEC, what other technologies could foams be used in?
6. What makes SPACE-TEC potentially useful for the space industry? What steps do you think are needed before nuclear-powered rockets or space stations become a reality?

Analysis

7. Geothermal energy is another means of generating electricity through heat – in this case using heat from the Earth's interior. Do you think TEC systems could be applicable for geothermal power plants? Why or why not?

Evaluation

8. Some people do not consider nuclear energy a 'clean' source of energy. Why do you think this is? What is your perspective? What role do you think nuclear energy should play in the future of society?
9. "It is incredibly rewarding to work on brand new ideas that nobody has tried before, but it doesn't come with an instruction manual – you have to figure it out as you go," says Austin. Would you enjoy working on cutting-edge science? What skills and attributes do you have that would help you? How could you prepare yourself to tackle some of science's biggest questions?

Activity

Imagine a point in the not-so-distant future when the government of your country is preparing to send several hundred volunteers to Mars to establish a colony. You are an engineer working on a now fully-operational SPACE-TEC system designed to provide power to small communities in hostile environments.

On your own or in small teams, design a presentation that aims to convince your government that your system is the best choice for providing power to the new Mars colony. Your presentation should address the following questions:

- How does your system work? What materials and processes does it involve?
- Why is your system ideal for a Martian community?
- What are the benefits, drawbacks, opportunities and risks associated with your system?
- Why is your system better than other systems that provide energy by other means?
- What would be necessary from other stakeholders (e.g., the government, colonisers, etc.) to make your system a success?

Be creative in your presentation design, thinking about what persuasive techniques you can best use to convince governmental officials. Draw on the article and your own online research to inform your points. Aim to use images, illustrations and graphics to make your presentation as accessible and engaging as possible. Remember: government officials may not have much knowledge of the topic, and may hold certain views related to nuclear energy.

Present your presentation to your class. Invite them to ask questions while role-playing as government officials and answer them to the best of your ability. Listen to their presentations too, and think about the similarities and differences between yours and theirs. What would you do differently if you were to do the task again?

More *resources*

• In this *Titans of Nuclear* podcast episode, Austin discusses his career path, his projects and what he loves about being a nuclear engineer: **lastenergy.com/titansofnuclear/experts/austinlo**
• This video from *Simply Space* explains how nuclear power is currently used in space probes and rovers – not via nuclear reactors, but via radioisotope thermal-electric generators (RTGs): **youtube.com/watch?v=wkVwWtRUqq4**
• This article from the *Nuclear Business Platform* gives an overview of ten important ongoing developments in, and applications of, nuclear energy: **nuclearbusiness-platform.com/media/insights/10-major-nuclear-energy-developments-to-watch-in-2025**