

THE BRIGHT IDEAS CHALLENGE

What will cities look like in 2050 – how will they be powered to be vibrant, healthy and clean places for people to live?

This Toolkit introduces The Bright Ideas Challenge. There's also a Classroom Presentation, a series of mini videos and a Student Workbook to bring the competition to life. These resources will help students devise an innovative solution to an energy problem faced by cities of the future.

Your school could win up to S\$5,000 in prize package to supersize your science, technology, engineering and maths teaching, plus individual student prizes and funded trips to Make the Future Live in London. Start the competition today!



#BrightIdeasChallenge

Terms and Conditions apply: shell.com.sg/brightideaschallenge

TEACHER TOOLKIT



hello

At Shell we're committed to inspiring the next generation of scientists and engineers. That's why we created The Bright Ideas Challenge – a cross-curricular schools competition that invites secondary students, aged 13-16, to imagine creative solutions to power future cities.

Scientists and engineers have revolutionised our world. They've cured diseases, transformed communications and sent mankind to the depths of the oceans and into space.

Through The Bright Ideas Challenge we hope to inspire young people about the positive role science, technology, engineering and maths (STEM) skills can play in society and to encourage students to become the engineers and scientists of tomorrow.

We're asking students to put their creativity, problem solving and STEM skills to the test – they could win individual student prizes, funded trips to Make the Future Live in London and up to S\$5,000 in prize package to super-size their STEM lessons.

We're delighted you've decided to get involved and hope this competition helps bring STEM to life for your students.

Make The Future Live

The competition is part of Make the Future Singapore, a four day festival of ideas and innovation hosted by Shell in Singapore.

The event is free of charge, and we're inviting school groups to join us. Students will have the opportunity to explore how we use and create energy in everyday life. They can take part in hands-on activities, interactive science shows and engaging careers experiences.

They can also watch teams battle it out in the world famous Shell Eco-marathon student mileage competition, which challenges more than 100 teams from across Asia Pacific to design and build the most fuel-efficient vehicles.

Find out more and register your school at shell.com.sg/brightideaschallenge



The energy challenge

Imagine you're in the future; it's 2050. You're living in a busy, highly populated city. What will it look like and how will it be powered to become a vibrant, healthy and clean place for people to live?

As populations grow and thrive, demand for energy grows as well. Energy to refrigerate food and medicines, to build roads and hospitals, to make plastics, fuels and fertilisers, to transport goods across the world and to the corner shop, and to enable access to better education and job opportunities.

But this increasing demand for energy is contributing to rising pressure on our climate. Enabling a decent way of life for people across the world, whilst addressing environmental stresses (including climate change) has never been more important. The big challenge, simply put, is how can the world produce and consume much more energy while emitting much less CO₂.

Challenges like this will be solved by the ingenuity of today's young people, which is why we're asking students to team up and apply their creativity, problem solving and STEM skills to help power the cities of the future.



Curriculum links

The competition has been developed to support cross-curricular learning for students aged 13-16 years old.

- ▶ Science
- ▶ Design and Technology
- ▶ Maths
- ▶ Computing
- ▶ Geography
- ▶ English



Entering the competition

Schools can enter multiple teams of pupils aged 13-16, but pupils cannot be a member of more than one team. Student teams must consist of two to five students.

To enter the competition you must, as a minimum, submit the following to steminc@science.edu.sg :

- ▶ A completed Bright Ideas Entry Form on behalf of each team
- ▶ A completed Teacher Cover Sheet, which confirms you accept the Terms and Conditions on behalf of your teams

Supporting materials

Teams can also submit supporting materials to bring their idea to life. These are optional and could include:

- ▶ A film (three minutes max)
- ▶ Computer generated visuals, photographs, technical drawings etc. (displayed on no more than two pages of A4)
- ▶ A physical prototype

Supporting materials should be sent via email alongside your teams' Bright Ideas Entry Forms. A separate film (three minutes max) demonstrating how the prototype works can also be sent.

For methods of submitting additional materials and full competition rules, please see our Terms and Conditions at shell.com.sg/brightideaschallenge

Prizes

- ▶ 1st place S\$5,000 prize package, plus a fully funded trip to Make the Future Live in London
- ▶ 2nd place S\$3,000 prize package
- ▶ 3rd place S\$1,500 in prize package
- ▶ 12 Merit Winners each winning S\$300 prize package






Any questions?

Read our FAQs and Terms and Conditions for details.

Resources available to use

The Bright Ideas Challenge is meant to be student led, so we've created a suite of resources to help guide your students step-by-step as they complete their entry:

- ▶ **Four mini videos**  to spark creative thinking and cover key concepts
- ▶ **A Student Workbook**  with activities and creative thinking techniques linked to each of the videos
- ▶ **A Classroom Presentation**  with notes to help you guide students through each activity and the process of putting together a quality entry
- ▶ **Four curriculum-linked ice-breaker activities** to get teams warmed up for the Challenge

The resources are designed to be used flexibly as part of a classroom project, a STEM enrichment day, as part of your regular scheme of work or as an activity for STEM Clubs. The competition activities can be completed in 2.5-5 hours, or more, depending on how you use the resources.



Suggested flow of activities

Practical ice-breaker activities

- ▶ Transport: Physics, D&T
- ▶ Water: Chemistry, D&T
- ▶ Buildings: Physics, D&T
- ▶ Power Generation: Physics, D&T
- ▶ Food: Biology, D&T

(45 minutes)

Watch video 1

The Bright Ideas Challenge

Activity 1 in Student Workbook

(55 minutes)

Watch video 2

Future cities

Activity 2 in Student Workbook

(55 minutes)

Watch video 3

Future technologies

Activity 3 in Student Workbook

(55 minutes)

Watch video 4

Share your bright idea

Teams complete the Bright Ideas Entry Form

(55 minutes)

Submit

- ▶ Teams' Bright Ideas Entry Forms
- ▶ Your Teacher Cover Sheet
- ▶ Any supporting materials

Use the Classroom Presentation 

Volunteers can use the Volunteer Guide

Inspiration

Here are just a few examples of ideas and innovations your students could explore to kick start their thinking:

- ▶ Could an app be developed to help people change their behaviours to save energy? There are lots already out there, but what might these apps need to achieve in a future city context?
- ▶ How does an aquaponics system work and could students design one that reduces energy use in food production?
- ▶ Could buildings be designed to be more efficient? Could they 'nudge' people to make choices that save energy? What concepts could be generated using sensors, switches or other technology that automatically turn off the heat, or which prompt people to take certain actions?
- ▶ How could biomass be used to create clean burning fuels to power a city? Are different kinds of biomass more efficient? How and where could these fuels be grown in a city?
- ▶ Scientists have discovered bacteria and microbes to clear up our pollution. How could bio-remediation technology be used to curb pollution in a future city?
- ▶ Can we use human energy to power devices? What might that look like?
- ▶ How could travel be made more efficient? How might people go to school, work, shopping and on holiday?
- ▶ What chemical reactions take place when we burn fuel? What is the chemical makeup of common fuels? Is it possible to make them burn more cleanly?
- ▶ How could pavements generate energy when people walk on them? How could sporting venues such as the National Stadium harness and use this energy? Could this also encourage healthier, more active future city citizens?
- ▶ How do hydrogen power cells work? How is it they emit water vapour? Could this technology be scaled up or used in an unexpected way?
- ▶ How is energy generated by different technologies? Could people or businesses generate their own energy? How would that work and what technology would work best?
- ▶ How might vertical or urban farms help reduce air pollution? Could these also contribute to creating habitats for animals and green space for people to enjoy?
- ▶ What kinds of materials make great insulators that could be used to make buildings more efficient?



Getting started: Ice-breaker activities

Recommended time:
 Up to 45 minutes

Use one of these bite-sized activities to get students working together on a practical problem linked to physics, chemistry, biology or design and technology.

These curriculum-linked activities introduce teams to the engineering design process and outline the design requirements that must be achieved to complete the tasks successfully.



Please ensure that all relevant safety measures and precautions are taken when completing the ice breaker activities. This includes the use of appropriate protective equipment such as safety goggles.

Activity 1: Understanding the energy challenge

Recommended time:
 Up to 55 minutes

Introduce your students to the competition and kick start a discussion about real world energy challenges. This activity is all about the role that STEM skills play in tackling big problems.




Learning objectives:

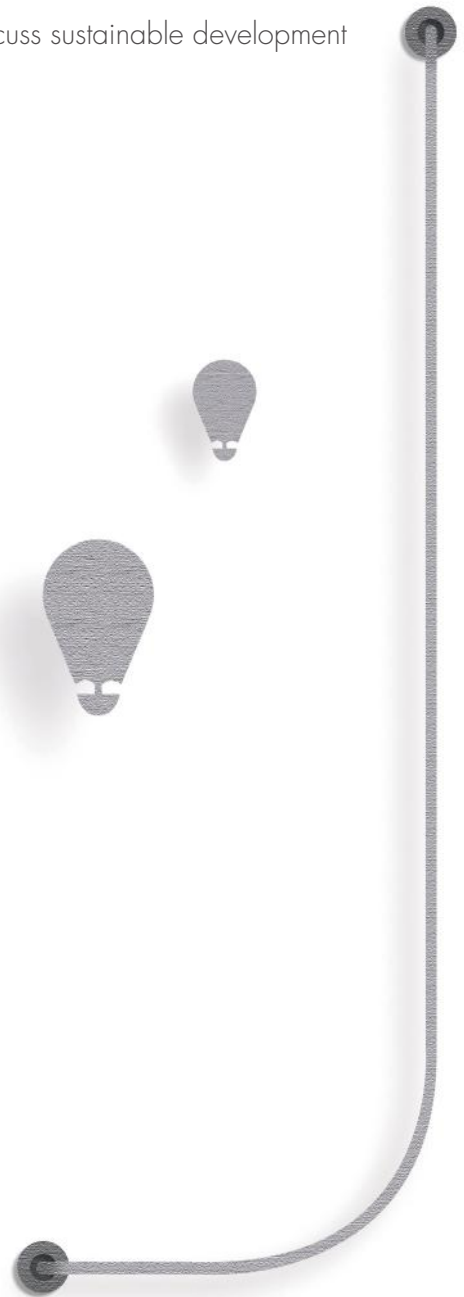
- ▶ Form a clear picture of what students need to do to enter The Bright Ideas Challenge
- ▶ Understand the importance of energy to quality of life and discuss sustainable development
- ▶ Apply project management skills and build a project plan

Curriculum links:

- ▶ Geography
- ▶ Biology
- ▶ Chemistry
- ▶ Physics
- ▶ Energy sources and sustainability

Materials required:

- ▶ Student Workbook (one copy per student) 
- ▶ Classroom Presentation - Activity 1 Slides 
- ▶ Internet access to view Video 1 



Steps:

1 Hand out a Student Workbook to each student, briefly outline the competition and watch **Video 1: The Bright Ideas Challenge** to introduce the competition and entry requirements.

 10 minutes

 Video 1

 Pages 1-2

Tip: Make sure you check the notes in the Classroom Presentation for prompts and talking points!

2 Have a brief initial class discussion to ensure students understand the core challenge being set using the prompts in the Classroom Presentation notes.

 20 minutes

 Pages 2-3

3 Organise students into teams of up to five, and explain that each team will be entering their work to The Bright Ideas Challenge. To do this, they'll need to work together to manage their project with the help of the videos and related activities in the Student Workbook.

 5 minutes

 Pages 2-3

4 Introduce teams to the Project Plan in the Student Workbook. This is a key project management tool that they can update as they go through the activities. Check that all teams are confident to start on their Project Plan.


 20 minutes


 Page 4

Extension:

Round off your session by discussing the concept of future scenario building as a class. Ask:

- ▶ What is future scenario planning and why is it important?
- ▶ Why might it be particularly useful when we're thinking about energy needs in the future?
- ▶ What kinds of expertise or knowledge might people like Martin, who works in Shell's Scenarios team, have?

 Classroom discussions: People and skills

 Page 5

Activity 2: Future cities

Recommended time:




 Up to 55 minutes

Support students as they apply their research and comprehension skills to explore the factors that shape how energy is generated and used, both now and in the context of a future city. Teams will then need to use this insight to identify a problem they'd like to solve using their STEM skills.

Learning objectives:

- ▶ Undertake focused research using the internet and/or library
- ▶ Collect, analyse and interpret data
- ▶ Understand how to reference sources
- ▶ Apply scientific knowledge to contemporary issues
- ▶ Apply project management skills

Materials required:

- ▶ Student Workbook 
- ▶ Classroom Presentation - Activity 2 Slides 
- ▶ Sticky notes/markers/flipchart paper
- ▶ Internet access to view Video 2 

Curriculum links:

- ▶ Geography
- ▶ Biology
- ▶ Chemistry
- ▶ Physics
- ▶ Computing
- ▶ Maths
- ▶ Design and Technology
- ▶ STEM Applied Learning Programme



Steps:

1 Play **Video 2: Future cities**. This video looks at issues and considerations that will shape the energy challenge, providing context and looking at the opportunities and problems faced by cities of the future.

 5 minutes

 Video 2

 Page 6

2 Kick start a class discussion on key trends or invite students to start straight away with their team using the mind mapping technique, which is explained in the Classroom Presentation. If available, provide students with flip chart paper to create their maps.

 10 minutes

 Page 6

3 Once students finish their mind maps, they'll likely need to 'fill in the gaps' with research. Ask students to plan their research using their Project Plan.

You can ask students to start their research with the web links provided in their Workbook. Teams can record their research facts, statistics, and insights plus the sources they used.

 30 minutes or homework

 Page 7

Tip: Judges will be looking for students to back up their research with solid sources – remind them to make note of where they find the facts they are using to back up their claims.

4 Ask students to regroup in their teams – it's time to choose the problem they want to focus on, based on their research.

 10 minutes

 Page 8

Tip: Encourage teams to be as specific and focused as possible with their chosen problem.

Extension

Teams can pull together a short presentation of their research findings and chosen problem in an 'elevator pitch', where students have two minutes to summarise their idea.

Activity 3: Future technologies

Recommended time:

 Up to 30 minutes

Students need to develop ideas around possible technologies and/or 'social' innovations that could solve their chosen energy problem.




Learning objectives:

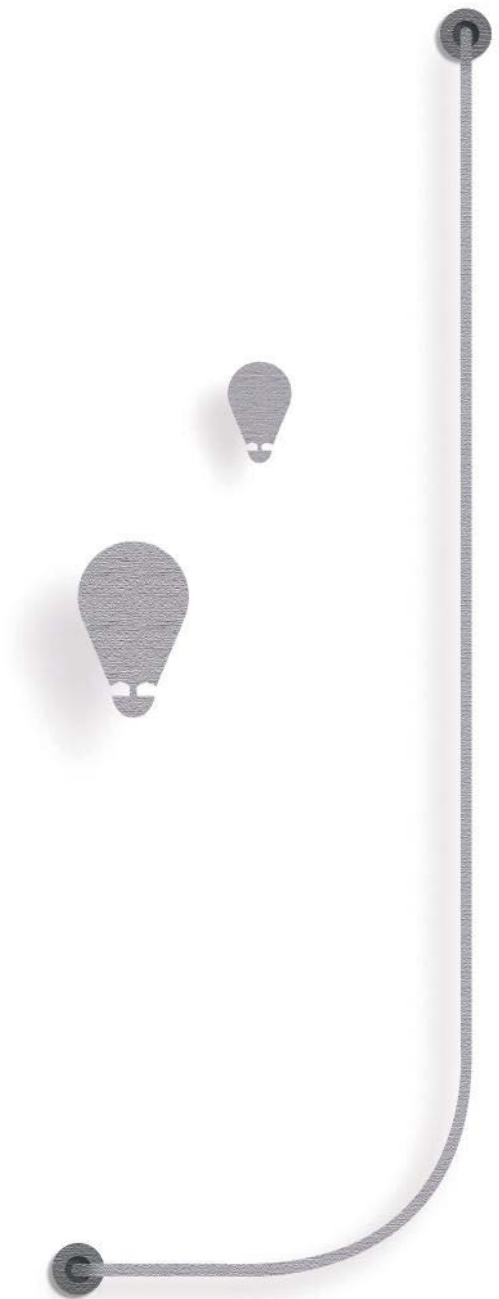
- ▶ Apply learning and knowledge gained through research to solve a problem
- ▶ Practise techniques for creative problem solving
- ▶ Work together respectfully and cooperatively
- ▶ Make decisions

Curriculum links:

- ▶ Geography
- ▶ Biology
- ▶ Chemistry
- ▶ Physics
- ▶ Computing
- ▶ Maths
- ▶ Design and Technology
- ▶ STEM Applied Learning Programme
- ▶ English

Materials required:

- ▶ Student Workbook 
- ▶ Classroom Presentation - Activity 3 Slides 
- ▶ Cut out Bright Ideas Generator Cards (at the back of this Toolkit. Several copies to share)
- ▶ Sticky notes/markers/flipchart paper
- ▶ Internet access to view Video 3 



Steps:

1 Play **Video 3: Future technologies**. Then kick start this activity with a group discussion around the themes and topics covered using the infographic in the Classroom Presentation.

 10 minutes

 Video 3

 Page 9

2 Distribute sticky notes, flip chart paper and pens to teams. Now it's time to pioneer some creative solutions to the future city energy problem they've chosen to tackle. We've suggested two creative thinking and problem solving tools they could try:

▶ Starbursting technique

▶ SWOT analysis

 20 minutes

 Pages 10-11

Tip: As students work, hand out the Bright Idea Generator Cards (see sheet at back of this pack) at random. These cards contain tools and techniques to help challenge their thinking and encourage them to be adventurous with their answers.



Tip: Students should also make notes about gaps in their knowledge where they may need to do more research to refine their idea – remind them they'll need to back up their idea with scientific facts and figures and demonstrate any technical knowledge in their final Bright Ideas Entry Form for the judges.

Extension:

 Classroom discussions: People and skills

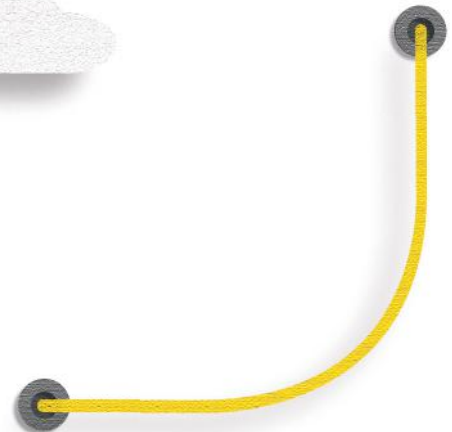
 Pages 12-13

Meet the team

Why not round off your session by meeting some of the people who help invent, design and build some of the technologies student may explore as part of their solution.

You could ask:

- ▶ What kinds of skills would they need to use in their roles every day?
- ▶ What parts of these roles seem surprising?
- ▶ Does it make you feel differently about STEM subjects and skills?



Activity 4: Complete your entry

Recommended time:

 Up to 55 minutes

Students bring together the results and outcomes of the previous steps to complete their competition entry.




Learning objectives:

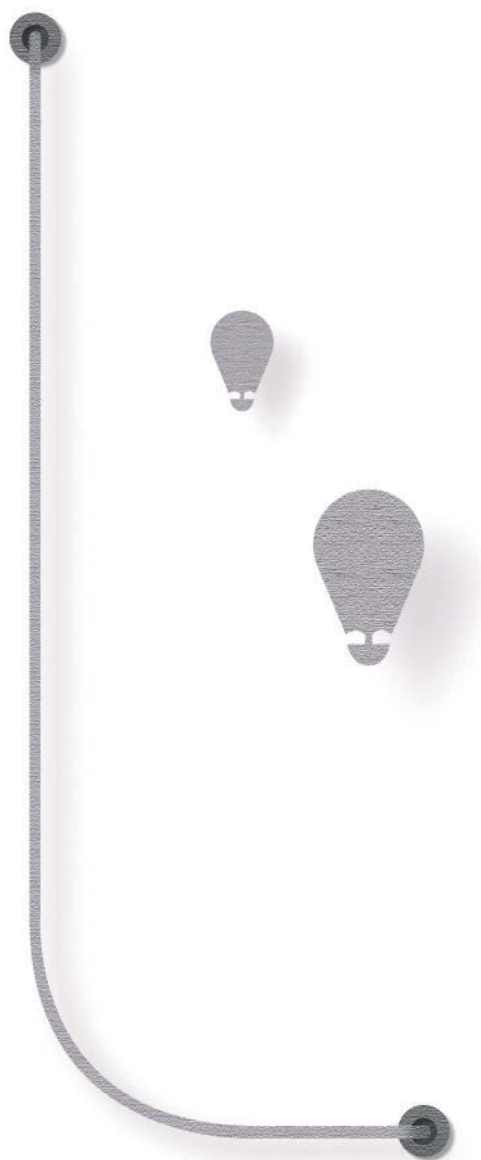
- ▶ Plan and complete the Bright Ideas Entry Form
- ▶ Communicate the project clearly in writing (alongside any supporting materials if desired)
- ▶ Reflect on individual skills and working as a team

Curriculum links:

- ▶ Geography
- ▶ Biology
- ▶ Chemistry
- ▶ Physics
- ▶ Computing
- ▶ Maths
- ▶ Design and Technology
- ▶ STEM Applied Learning Programme
- ▶ English

Materials required:


- ▶ Student Workbook 
- ▶ Bright Ideas Entry Form (one per team)
- ▶ Internet access to view Video 4 
- ▶ Classroom Presentation - Activity 4 slides 



1 Play **Video 4: Share your bright idea.**

Distribute one copy of the Bright Ideas Entry Form to each team. Ensure students are clear on what's required of them to submit a valid entry. Teams will need to:

- ▶ Complete one Bright Ideas Entry Form per team – ensuring sections 1-6 are complete
- ▶ Teams can also submit optional supporting materials, such as:
 - ▶ Film (three minutes max);
 - ▶ Computer generated visuals, photographs, technical drawings etc.; (displayed on no more than two pages of A4)
 - ▶ A physical prototype

 **15 minutes**

 Video 4

 Page 14

2 Outline sections 1-6 of the Bright Ideas Entry Form to ensure students are clear on what's being asked.

Lead a short discussion on how teams might put together a quality entry using prompts in the Classroom Presentation.

 **10 minutes**

Tip: Why not spend 10 minutes with each team so they can talk you through their plan. You can support them in identifying any gaps, extra support required and/or help them access materials and equipment if they choose to create supporting materials.

3 Collaboration and team work is crucial to innovating new ideas – they are also important skills for any career in STEM. Encourage teams to tap into the different skills and strengths they have as they complete the activities and to record these in section 6 on the entry form.

 **5 minutes**

 Page 14

4 And finally, set teams loose on completing the Bright Ideas Entry Form, and any supporting materials they are inspired to produce.

 **30 minutes** and/or homework



Bright Ideas Generator Cards

Print and photocopy this page before cutting up and handing out cards during Activity 3. These aim to encourage students to look at problems from another angle!



Make it worse

Think about ways you could make your chosen energy problem even worse!

How would you prevent that from happening? Add any ideas to your thinking.



Forbidden words

Are you stuck on a certain word or theme like 'renewable', 'efficiency', 'transport' – or a specific technology?

Try to come up with three ideas that don't use that word – see where that gets you!



Social and economic impacts

Beyond saving or generating energy – try to list three ways your idea could:

- 1 Help people live healthier lives: will it encourage people to be more active, eat better food, connect with their community, etc.
- 2 Support local business/ the economy: will it provide opportunity for local business to grow or help citizens generate income, etc.
- 3 Help the surrounding natural environment: could it save or improve habitats for animals, clean waterways or improve air pollution, etc.



In the firing line

Does someone on your team have an idea with potential?

Get them to stand up in front of the team and pepper them with rapid-fire questions – anything that comes to mind.

The presenter should answer the questions as quickly as possible with whatever pops into their head.

Don't forget to write it all down!



Technology or behaviour?

Try thinking of three ideas that involve:

- 1 Developing a new technology
- 2 Changing people's behaviours so they make choices that use less energy – or even generate energy (what might that look like?)

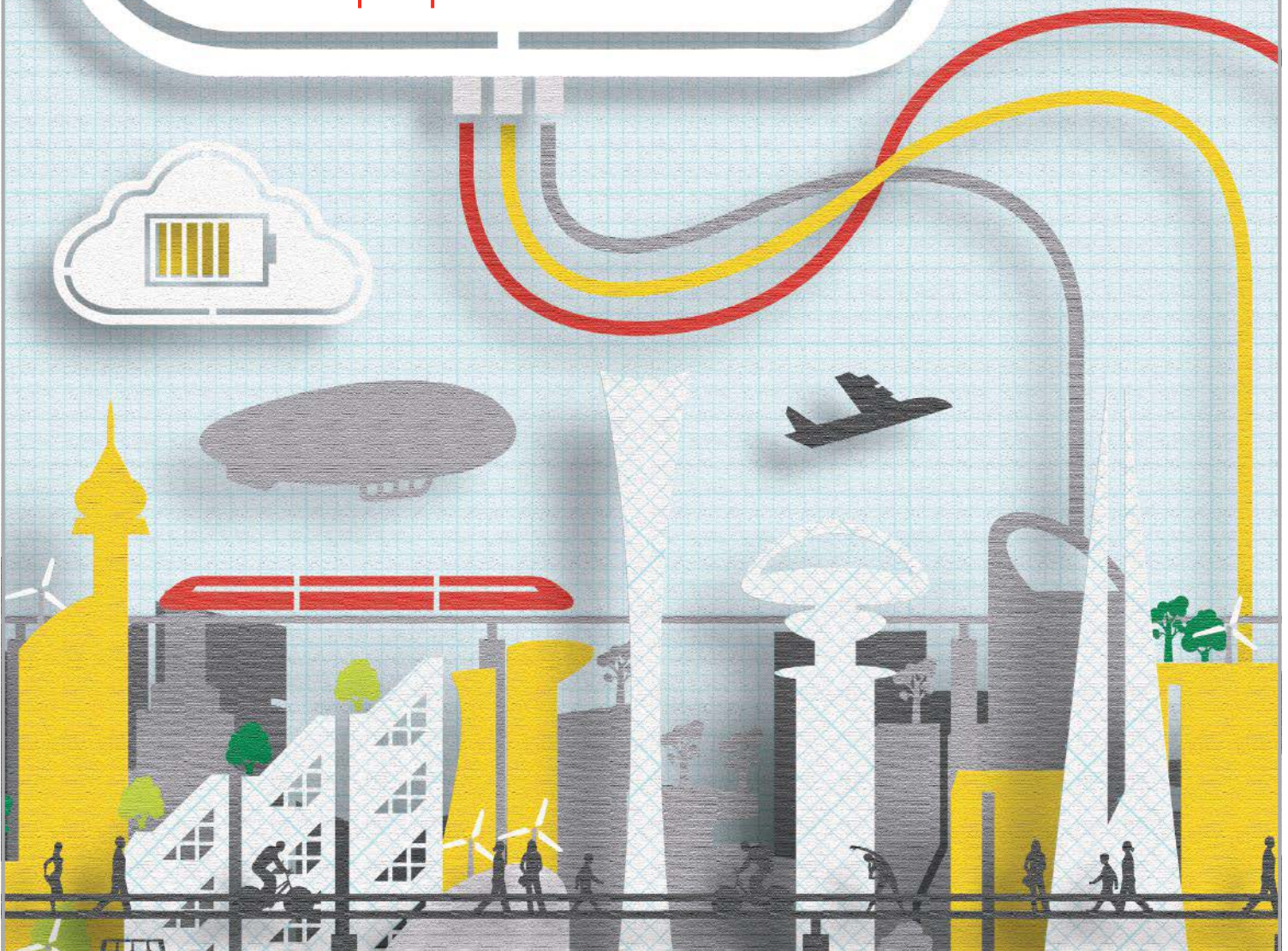
Shell's support for STEM education

Shell has supported STEM education for nearly 40 years in Singapore. By inspiring more young people to become scientists and engineers we can reduce the Singapore's shortage of STEM skills and ensure today's young people have the skills they need to secure fulfilling jobs in an ever-expanding sector. We've outlined some of our key programmes below, but for more information [visit shell.com.sg/STEM](http://shell.com.sg/STEM)



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