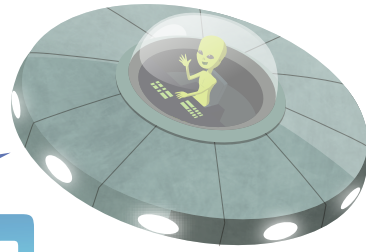


INTERGALACTIC POWER PROBLEMS



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HI THERE! IT'S **RICHARD** AND MY **UTILITY SURVEY SUPPORT DOG AMBER** FROM **UTSS**. I'M IN THE MIDDLE OF DEALING WITH A PESKY POWER PROBLEM! SOMEWHERE IN THE UTILITIES EXPLORATION POSTER THERE'S A POWER DRAIN: SOMEONE OR SOMETHING IS SAPPING ELECTRICITY FROM THE POWER GRID! ONE OF MY MANY JOBS IS TO SURVEY AND HELP MAINTAIN POWERLINES -- AND I'LL BE IN A TON OF TROUBLE IF I DON'T GET MIDDLETOWN'S JUICE FLOWING AGAIN SOON! CAN YOU HELP ME FIND THE PROBLEM? AND THEN, EVEN MORE IMPORTANTLY, HELP ME FIX THINGS!

TASK 1: THE PARTICULARS OF POWER

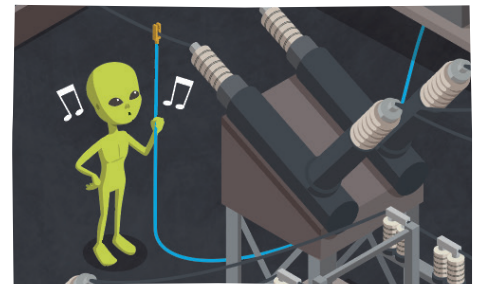
(SCIENCE OBJECTIVES - ELECTRICITY)

I think we've spotted the problem! Did you see it? Have a look in G,5 and you'll find an extra-terrestrial energy thief, helping themselves to our electricity! Perhaps they ran out of gas whizzing through the Milky Way, and they thought our big blue and green planet was an intergalactic filling station! They've certainly caused a drain at this power substation. Those overhead powerlines that link to the national grid (a network of powerlines, pylons, gas lines and

interconnectors, which allows electricity to be transmitted to meet power demands across the country) have a fraction of the current they're supposed to be carrying! But what the alien hasn't realised is that this might not be the most efficient way of charging their ship; it's taking so long that those secret agents are about to 'Area 51' his green behind!

For your first challenge, can you use the 'Particulars of Power' worksheet to understand how electricity is generated and

transmitted? Once you've got it clear in your mind, we can see if we can find a way to help the alien make their escape - and get the power flowing in Middletown again!



TASK 2: WINNING WITH WIND

(SCIENCE OBJECTIVES - ELECTRICITY/FORCES / ART OBJECTIVES - PAPERCRAFT)

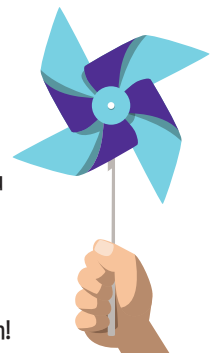
While we're thinking about power, there's a few different methods of making energy going on around Middletown. Can you see any? What about in H,1? This is called a wind turbine. It uses the power of wind to create electricity. Wind turbines consist of three main parts: a set of blades, a box next to the blades called a nacelle (which contains all the generating components), and a shaft. The blades are designed in such a way that even a gentle breeze will make them spin, which creates kinetic (movement) energy. This movement makes a shaft inside the nacelle spin, and a generator converts this kinetic energy into electrical energy.



It might surprise you to find out that wind turbines that produce electricity have been around for over 130 years! The Jiuquan Wind Power Base is the largest wind farm in the world - with a planned 7,000 wind turbines! And one of the largest wind turbines in the world (CSSC Haizhuang's H260-18MW, with blades measuring a whopping 128m in length) is capable of sweeping an area the size of ten football fields per spin! All this amazing energy-generating technology requires a ton of planning - and that's where GeoSurveyors

like UTSS come in. They can help scan potential locations, then plan for the positioning and installation of the wind turbines. This is super important, as the turbines need to be put in places that allow them to operate at maximum efficiency. Wind turbines generate clean, renewable energy, which is great for the planet, and great for us!

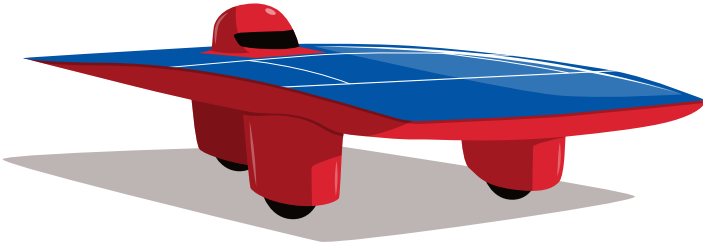
For your challenge, have a go at creating your very own miniature wind turbine! Follow the instructions on the 'Winning with Wind' worksheet to make your own paper pinwheel - you can even ditch the traditional white turbine colour scheme and add your own colourful design!



TASK 3: SUNSHINE AND POWER LINES

(SCIENCE OBJECTIVES - ELECTRICITY/LIGHT / DESIGN TECHNOLOGY OBJECTIVES - VEHICLE DESIGN)

There's one more way that the people of Middletown are harnessing the power of their environment to generate energy. Can you spot it? Take a look at the roofs of the Survey HQ and City Utilities buildings. Those dark, shiny panels are solar panels, and they're soaking up the power of the sun. The panels have solar cells, also called photovoltaic cells, which convert sunlight into electricity. Electrons in each cell move when sunlight hits them, creating a current that -



when combined with the current from all the other cells - produces a useful amount of energy. Solar energy is very reliable, which is why it's used on space satellites and in remote areas where it's difficult to access or generate electricity! Solar technology has also been applied in many different areas, such as small devices (watches and calculators) and vehicles (such as cars, boats and trains) - there's even an ongoing world record challenge for the fastest solar-powered car. The record speed currently stands at 91.332 km/h, set by the Sky Ace TIGA.

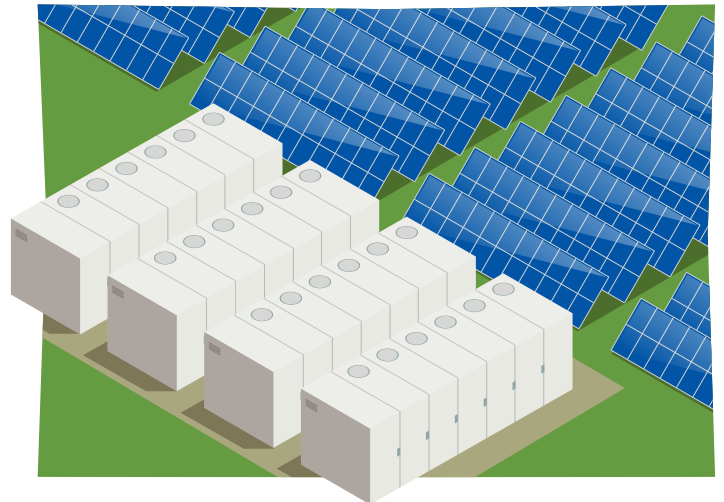
However, this solar-powered speedster won't win any awards for practicality! The driver couldn't even give a buddy a lift, nevermind fitting any luggage onboard! That's where you come in. Can you use your knowledge of solar power technology to design a vehicle that would look at home on the Middletown streets? Think about where and how you would fit the solar panels, and how you might protect them from damage.

TASK 4: BIG BAD BATTERIES

(SCIENCE OBJECTIVES - ELECTRICITY / HISTORY OBJECTIVES - STUDYING CHANGE OVER TIME)

No matter where the electricity comes from, chances are it's going to need to be stored and distributed. Battery storage, also known as battery energy storage systems (BESS), are devices in facilities that allow energy from sources like the ones we have looked at (solar and wind) to be stored, then released when the power is most needed.

Before we turn our attention back to our alien visitor - armed with new knowledge about energy sources, transmission and storage - could you complete your own research project on the history of batteries? From the 'Baghdad Battery', all the way to the modern units powering our devices today, make sure you include names, dates and places for all the influential battery inventors you discover along the way!



TASK 5: CODE ENCOUNTERS

(LITERACY OBJECTIVES - DECIPHERING MEANING / DESIGN TECHNOLOGY OBJECTIVES - EVALUATE AND IMPROVE A DESIGN)

While you've been busy learning all about the various energy-generating tech around Middletown, we've received a message from the alien, scrawled into the dirt with a long, green finger. Here's what they said:



We've been working on a key to unlock the message's hidden meaning; we think it's a clue about the type of fuel source the alien needs to get their spacecraft going. For your final challenge, could you complete the 'Code Encounters' worksheet and use the key to crack the alien's coded message, then modify the sketch of their spacecraft to include tech that will help them harness whatever energy they need? Once they disconnect from the power grid, we'll be able to get Middletown's utilities back on track!

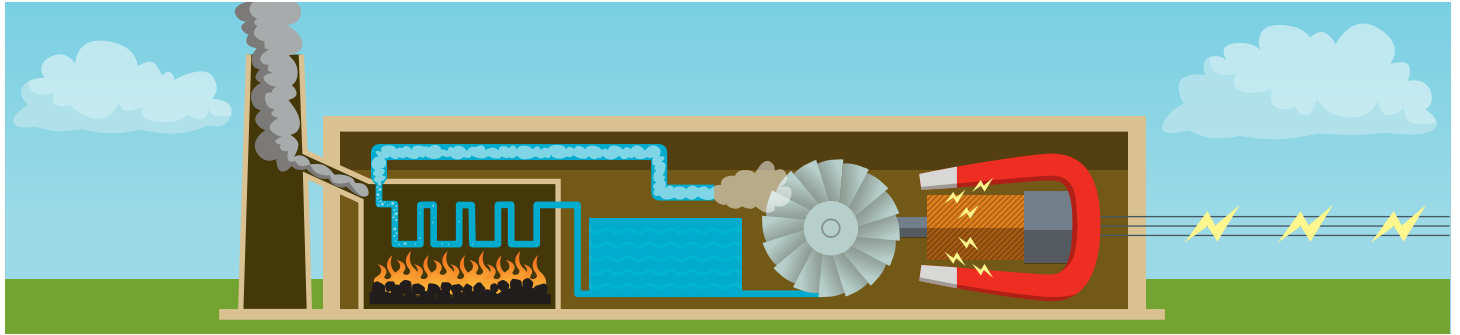


PARTICULARS OF POWER

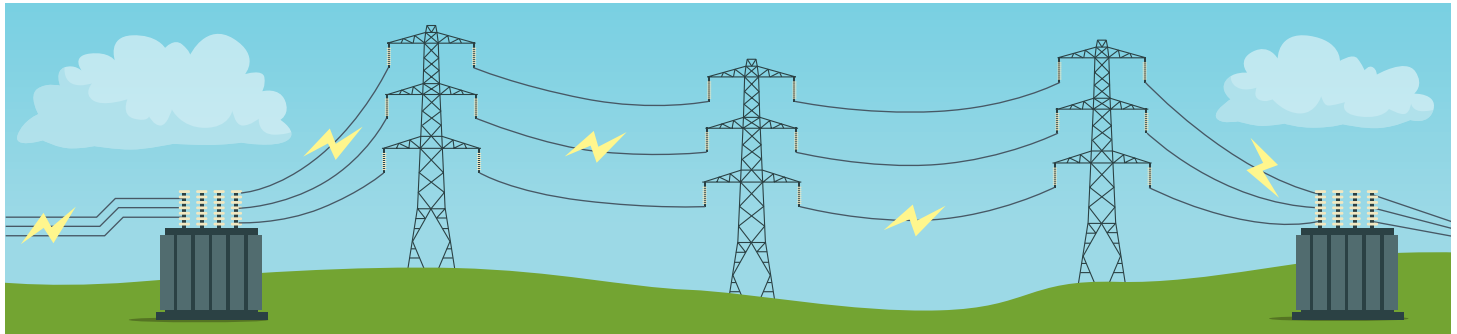
FOR YOUR FIRST CHALLENGE, CAN YOU USE THIS WORKSHEET TO UNDERSTAND HOW ELECTRICITY IS GENERATED AND TRANSMITTED? ONCE YOU'VE GOT IT CLEAR IN YOUR MIND, WE CAN SEE IF WE CAN FIND A WAY TO HELP THE ALIEN MAKE THEIR ESCAPE -- AND GET THE POWER FLOWING IN MIDDLETOWN AGAIN!

WORD BANK		
WEAK	WIRE	STEAM
INCREASED	MAGNET	DOWN
	MAINS	TRANSFORMER
CURRENT	FUEL	PYLONS

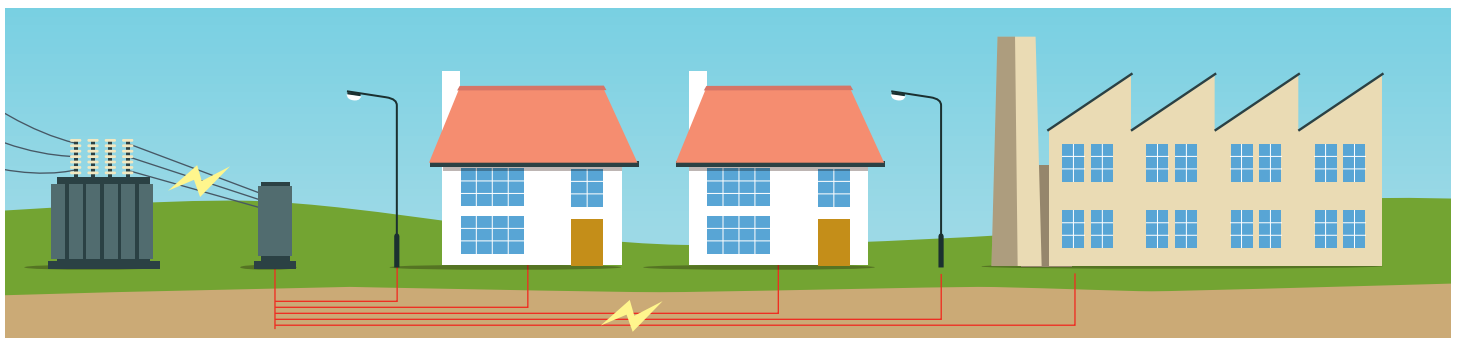
Use the key words from the word bank to complete the explanation of electricity's journey!



In a traditional power station, _____ is burned, and the heat is used to turn water into _____. The pressure created by the steam pushes the blades of a turbine, which turns a coil of copper _____ between the poles of a large _____. Electrons are pulled from the copper and collected in a wire, forming an electric _____.



The current generated at the power station is too _____ to reach all the way to houses and buildings, so it is sent through a device called a transformer, where power is _____ or 'stepped up'. The more powerful current is transmitted through cables buried underground or strung along tall _____.



Before the current reaches houses or buildings, it goes through another _____ to have its power reduced, or stepped _____. The reduced current runs into electric _____ - cables under the street that feed electricity to each individual building.





WIN WITH WIND

FOLLOW THESE INSTRUCTIONS TO MAKE YOUR OWN PAPER PINWHEEL -- YOU CAN EVEN DITCH THE TRADITIONAL WHITE TURBINE COLOUR SCHEME AND ADD YOUR OWN COLOURFUL DESIGN! MAKE SURE YOU ASK FOR AN ADULT'S HELP WHEN USING SHARP OBJECTS.

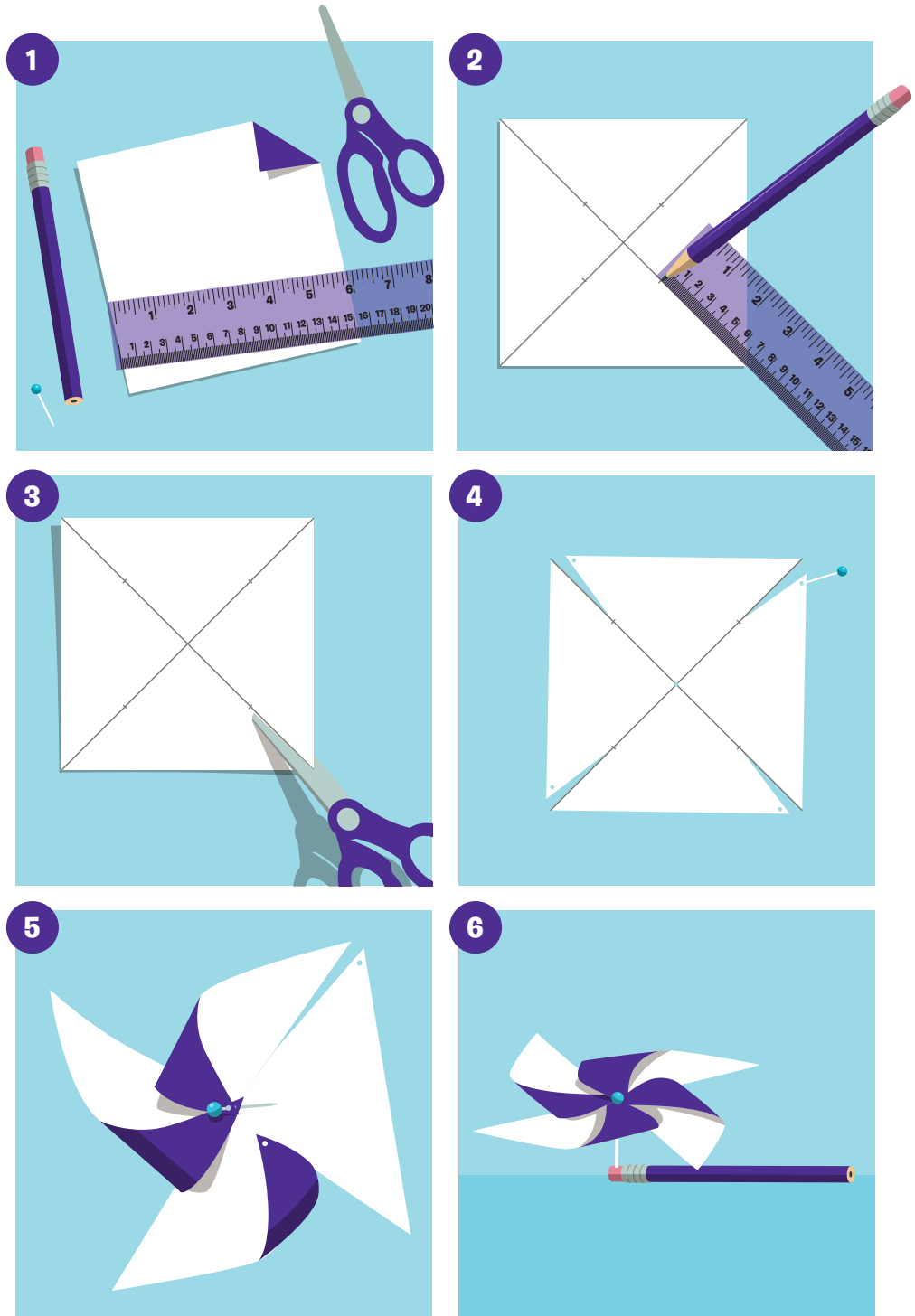
What you'll need:

- Paper
- An unsharpened pencil with a rubber
- A pin with a ball top
- Scissors
- Ruler
- Pencil

Instructions:

1. Cut a 15 cm square piece of paper.
2. Draw two diagonal lines from corner to corner, crossing at the centre of the square.
3. Mark the centre point and mark a point 7cm away from each corner on the diagonal line. Cut along the diagonal line from each corner towards the centre, stopping at the marked point.
4. Using the pin, punch one hole through the centre of the paper, and one in every other point, close to the tip.
5. Poke the pin through each of the point holes and curl the piece toward the centre. With each pierced point threaded onto the pin and curled towards the centre, push the pin through the centre hole of the pinwheel.
6. With the pencil on a flat surface, push the pin into the side of the rubber.

You now have a working pinwheel - or a miniature turbine! Blow into the blades and watch it spin - or take it outside and see if you can use wind power to get your turbine moving!





CODE ENCOUNTERS

FOR YOUR FINAL CHALLENGE, USE THE KEY TO CRACK THE ALIEN'S CODED MESSAGE, THEN MODIFY THE SKETCH OF THEIR SPACECRAFT TO INCLUDE TECH THAT WILL HELP THEM HARNESS WHATEVER ENERGY THEY NEED. ONCE THEY DISCONNECT FROM THE POWER GRID, WE'LL BE ABLE TO GET MIDDLETOWN'S UTILITIES BACK ON TRACK!

THE KEY:

A	B	C	D	E	F	G	H	I	J	K	L	M
7	2	8	9	3	4	5	6	0	1	4	5	6
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
7	8	9	0	1	2	3	4	5	6	7	8	9

THE MESSAGE:

8 4 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

THE TRANSLATION:

MODIFIED SHIP DESIGN:

