How will NSW keep the lights on?

Investigation record

Name: _____ Class: _____ Date: _____

Keep this record as you work through the lesson. Each part has the number of the screen it goes with. The practical tables can be used with real kits as well as with the models.

SCREEN 1 Our driving question board

Tick each question you pin. When a screen helps answer it, write what you figured out and the screen number.

PIN	QUESTION	WHAT WE FIGURED OUT	SCREEN
MAKING ELECTRICITY			
☐	How does burning coal make electricity?		
☐	Do wind farms and hydro stations make electricity the same way coal stations do?		
☐	Why does a solar panel make less power on some days than others?		
WHERE TO BUILD			
☐	Why are the coal stations where they are?		
☐	Why are solar farms out west and wind farms on the tablelands?		
☐	Where are the best places for new wind and solar farms?		
WHO DECIDES			
☐	Who gets a say in where a wind farm or power line goes?		
☐	What do Aboriginal communities, farmers and towns get out of new projects?		
KEEPING SUPPLY STEADY			
☐	Where does the power come from at night, when there is no sun?		
☐	What happens if the wind stops for days?		
☐	Can batteries and Snowy 2.0 do the job of a coal station?		
☐	Will the lights go out when Eraring closes?		
HOW MUCH WE NEED			
☐	What does Australia use all this energy for?		
☐	Will NSW need more electricity in future, or less?		
☐	Why not keep the coal stations open?		
OUR OWN QUESTIONS			
☐			
☐			
☐			

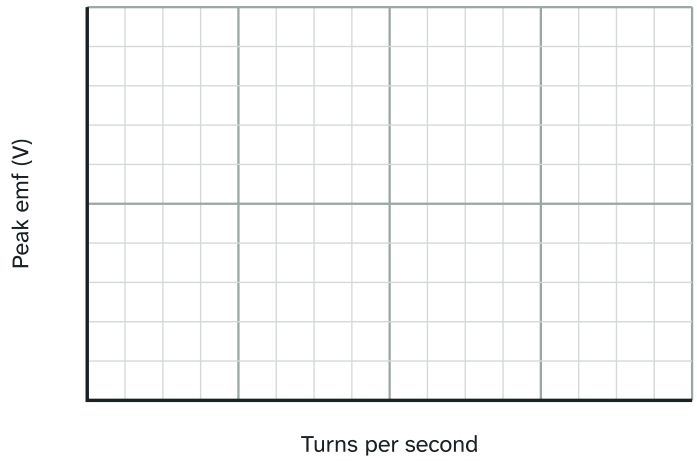
SCREEN 1 My first answer

Write your first answer to the driving question, how will NSW keep the lights on, even if you are not sure yet. You will come back to it on screen 10.

SCREEN 2 Generate a current with a turbine

Change one thing at a time: the speed of the wheel, the number of turns in the coil or the magnet. Record the peak emf each time.

TURNS IN THE COIL	MAGNETIC FIELD (T)	TURNS PER SECOND	PEAK EMF (V)	FREQUENCY (HZ)



Plot the peak emf against turns per second for one coil and one magnet. Describe the shape of your graph.

What happened to the peak emf when you doubled the number of turns? Explain why.

SCREEN 3 What changes a solar cell's output?

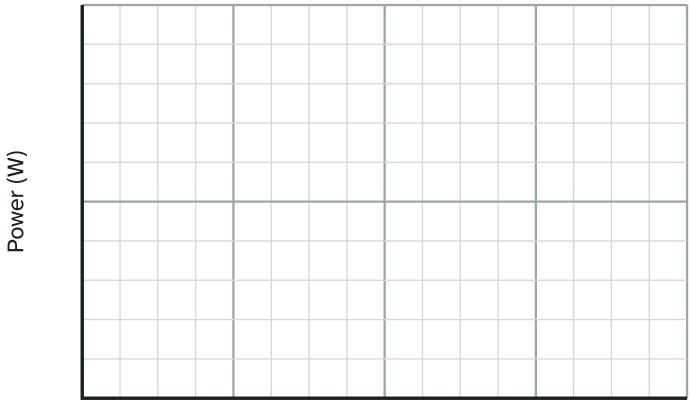
Choose one factor to test: the distance from the lamp, the angle of the panel, the shading or the temperature. Keep the other three the same, and record at least five readings spread across the range.

The factor I changed: _____

What I measured: _____

What I kept the same: _____

VALUE OF THE FACTOR, WITH ITS UNIT	VOLTAGE (V)	CURRENT (A)	POWER (W) = V × A



Plot the power against the factor you changed. Describe the pattern, and explain it.

SCREEN 4 Where the power stations are, and why

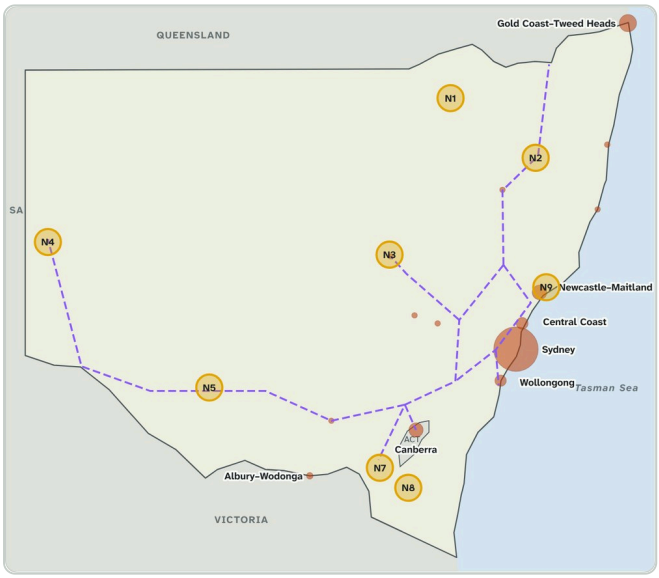
For each kind of power station, write what it needs and which layers on the map explain where it is.

KIND OF STATION	WHAT IT NEEDS	THE MAP LAYERS THAT EXPLAIN WHERE IT IS	AN EXAMPLE IN NSW
Coal			
Gas			
Hydro			
Wind			
Solar			

SCREEN 5 The renewable energy zones

AEMO grades each zone for solar and for wind, with A the best. The last two columns are AEMO's grades for how closely the zone's solar or wind output follows NSW's demand for electricity.

ZONE	SOLAR GRADE	WIND GRADE	RAIN (MM A YEAR)	HEIGHT (M)	LAND	NEAREST BIG CITY	SOLAR MATCHES DEMAND	WIND MATCHES DEMAND
N1 North West NSW Moree Aero	**B**	**E**	577	213	Flat plains	Gold Coast–Tweed Heads, 390 km	**F**	**A**
N2 New England Armidale Airport	**C**	**C**	783	1,079	High tableland with ridges	Newcastle–Maitland, 260 km	**F**	**A/B**
N3 Central-West Orana Dubbo Airport	**C**	**C**	588	284	Gently rolling plains and ranges	Central Coast, 290 km	**F**	**A**
N4 Broken Hill Broken Hill Airport	**A**	**D**	250	281	Dry plains and low ranges	Albury–Wodonga, 680 km	**F**	**A**
N5 South West NSW Hay Airport	**C**	**E**	355	92	Flat plains	Albury–Wodonga, 260 km	**F**	**B**
N7 Tumut Cabramurra	**F**	**E**	1,253	1,482	Steep mountains and deep valleys	Canberra–Queanbeyan, 100 km	**F**	**D/C**
N8 Cooma-Monaro Cooma Airport	**F**	**B**	538	930	High, open plains and hills	Canberra–Queanbeyan, 110 km	**F**	**C**
N9 Hunter-Central Coast Williamtown	**D**	**D**	1,137	8	Valleys, coast and coal-mining land	Newcastle–Maitland, 20 km	**F**	**A/B**



The zones on screen 5, with the main lines and the big cities. Grades from AEMO's 2024 Integrated System Plan.

Capacity factor for each grade

GRADE	SOLAR	WIND
A	30% or more	45% or more
B	28–30%	40–45%
C	26–28%	35–40%
D	24–26%	30–35%
E	22–24%	under 30%
F	under 22%	–

A year's energy = size (MW) × capacity factor × 8,760 hours. Use the bottom of the zone's band.

My farm: _____ MW × _____ × 8,760 hours = _____ MWh

Which zone would you choose for a new wind farm, and which for a new solar farm? Use at least three kinds of data in your reasons.

SCREEN 7 How long can each store run?

Work out how long each store can run at full power.

STORE	POWER (MW)	ENERGY (MWH)	HOURS AT FULL POWER (MWH ÷ MW)
Waratah Super Battery	850	1,680	
Eraring battery, stage 1	460	1,770	
Snowy 2.0	2,200	350,000	

Which store could keep going through a wind lull of three days, and which can cover only an evening peak? Use your hours.

SCREEN 9 The Energy Security Target

These are the figures from the NSW Government's 2025 check, which assumed Eraring would close in August 2027. Subtract to find the spare (+) or short (–) capacity in each year.

YEAR	TARGET (MW)	FIRM CAPACITY (MW)	SPARE (+) OR SHORT (–) (MW)
2025-26	15,753	16,848	
2026-27	15,968	18,053	
2027-28	16,084	15,810	
2028-29	16,257	16,280	
2029-30	16,464	18,885	
2030-31	16,822	19,775	
2031-32	17,256	19,842	
2032-33	17,561	20,093	
2033-34	17,821	16,256	
2034-35	18,073	17,181	

Which years are short of the target? What happens to the 2027-28 gap if Eraring stays open until April 2029?

The 2025 check counted 12.4% of a wind farm's capacity at the summer peak, 85% of a 4-hour battery's, and all of an 8-hour store's or a gas station's. How many MW of new wind farms would close the 2033-34 gap on their own? How many MW of 4-hour batteries?

SCREEN 10

My answer

Plan your answer to the driving question. Write three claims, the evidence for each with its screen number, and the reasoning that links the evidence to the claim.

CLAIM	EVIDENCE, WITH ITS SCREEN	REASONING

Read the first answer you wrote on screen 1. What has changed in your thinking, and which piece of evidence changed it most?

Which question on your board is still open? How could you find the answer?