



NETWORKS

Lesson 03

Wind Energy



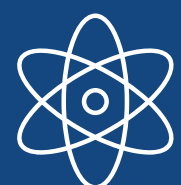
Learning Intentions

At the end of this lesson students should be able to

- Understand why wind energy generation is a more sustainable energy source compared to non-renewables.
- Identify benefits and challenges of wind energy.
- Describe the generation and use of wind energy in Ireland, including links between the physical landscape and the placement of wind turbines.

What is electricity?

What is Electricity?



Electricity is the energy generated when electrons (the particles in atoms) move and create a current.



Electrons have a negative charge and are attracted to things that have a positive charge.



When you plug something in, this flow of electrons goes from the socket, through the wires, and into the device. When you unplug it, the flow of electrons stops.



Electricity travels at the speed of light: That's approximately 300,000 kilometres per second!

What is a Watt?

A Watt is a term used to describe the rate at which electricity is used.



One watt is defined as one Joule per second, where a Joule is a unit of electricity.



The watt is a measure of power, you will see this unit listed on your electrical appliances.



A 40-watt filament lightbulb uses 40 Joules of electricity each second – **a modern LED lightbulb can use 80% less electricity** to emit the same amount of light.

What is a Kilowatt-hour?



Sometimes shortened to kWh, the kilowatt-hour is used to measure electricity consumption.



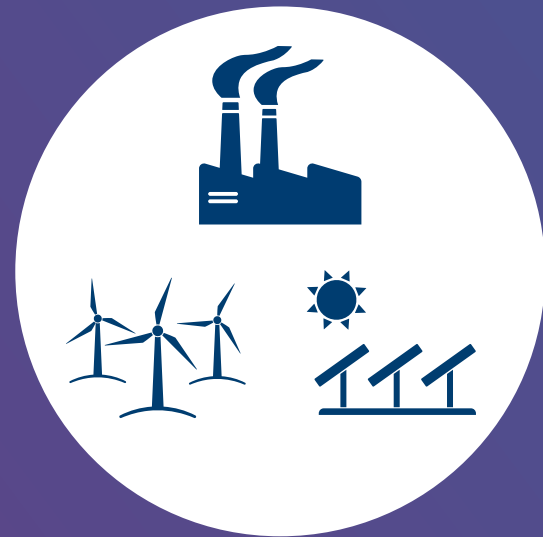
One kWh is the amount of electricity that would be used by a 1000-watt appliance in one hour, or a 500-watt appliance in two hours.



On Electricity bills, one kWh is typically **one "unit" of electricity consumed**. Prices are usually set as a certain value per kWh and vary depending on the electricity tariff.

About our electricity network

The electricity system in Ireland supplies 2.5 million customers with power across the island of Ireland.



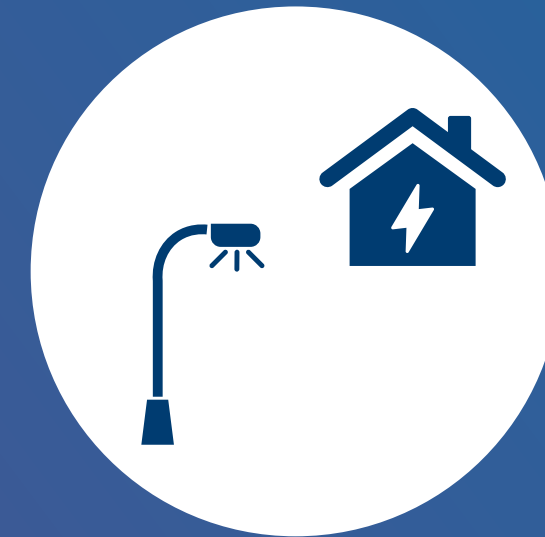
Electricity Generation

- Non-renewable energy sources, e.g., burning oil, coal or gas.
- Renewable energy sources, e.g., wind and solar power.
- Interconnectors, which allow Ireland to import electricity from the UK or France.



Electricity Transmission

- Electricity is generated in a high voltage form that needs to be converted to a lower voltage for general use.
- This happens at electricity substations around the country.



Electricity Distribution

- Once the electricity is at a safe voltage to be used, it is distributed to homes and businesses by a more local network.



Electricity Use

- Electricity suppliers buy electricity from generators and sell it to consumers and businesses.

You use electricity in your homes to make tea, turn your lights on, wash your clothes etc.

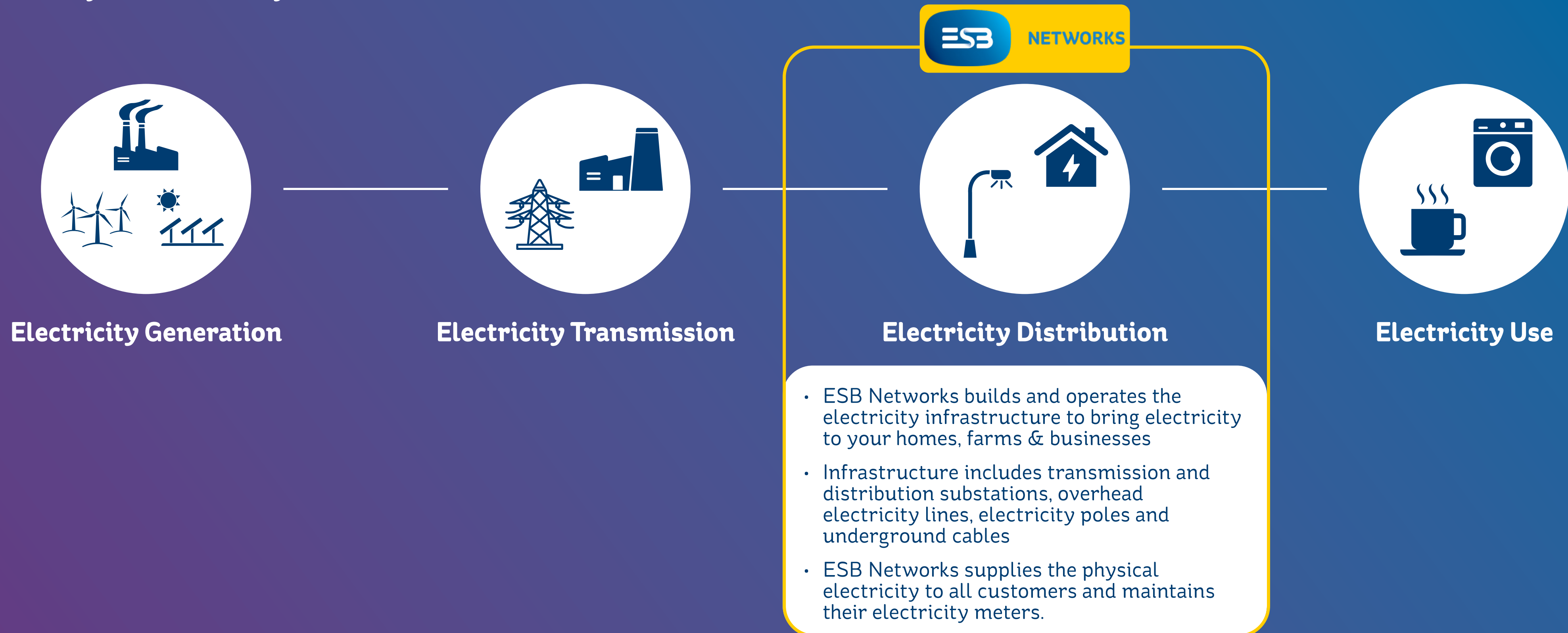
Ireland has goals for renewable energy to become the main way of powering homes and businesses by the end of the decade.

FUN FACT

Ireland has been making significant strides in renewable energy. In 2024, **wind power accounted for 32% of the country's electricity generation**, making it one of the leading sources of renewable energy in Ireland.

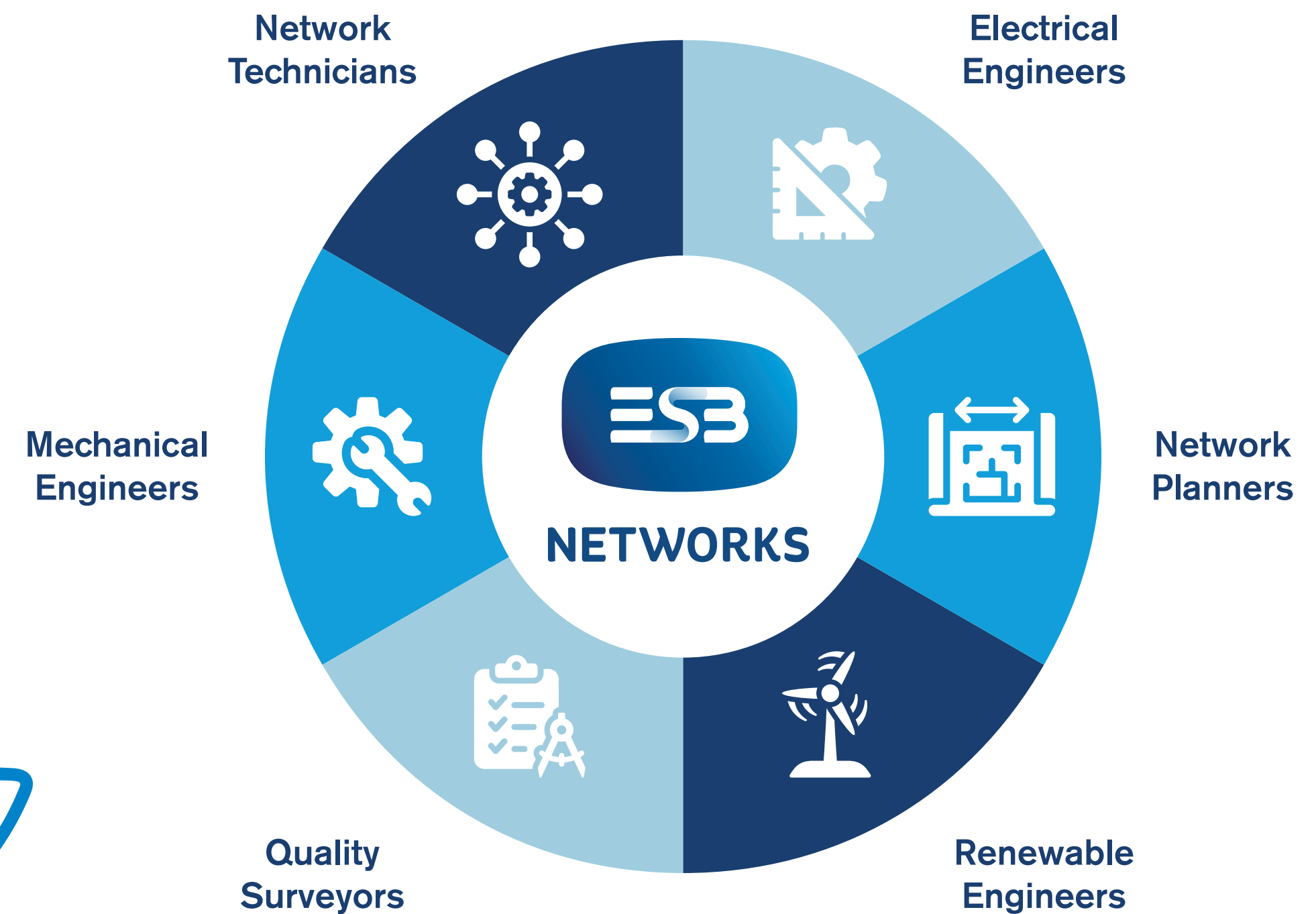
Who are ESB Networks?

ESB Networks is responsible for the safe and reliable supply of electricity to over 2.5 million customers across Ireland. ESB Networks oversees the design, construction, and maintenance of the electricity network to ensure the seamless delivery of electricity



How does ESB Networks maintain and manage the distribution system?

As outlined here, many different people are involved in maintaining, managing and developing the electricity network in ESB Networks.



Fossil Fuels

These energy sources contribute the most to climate change

- Fossil fuels – coal, oil and gas – are by far the largest contributor to global climate change, accounting for over 75 per cent of global greenhouse gas emissions and nearly 90 per cent of all carbon dioxide emissions. These emissions then contribute to climate change.
- Generating energy from the wind does not release any carbon emissions. By replacing electricity generated from fossil fuel sources, wind energy can lead to an overall reduction in carbon emissions.



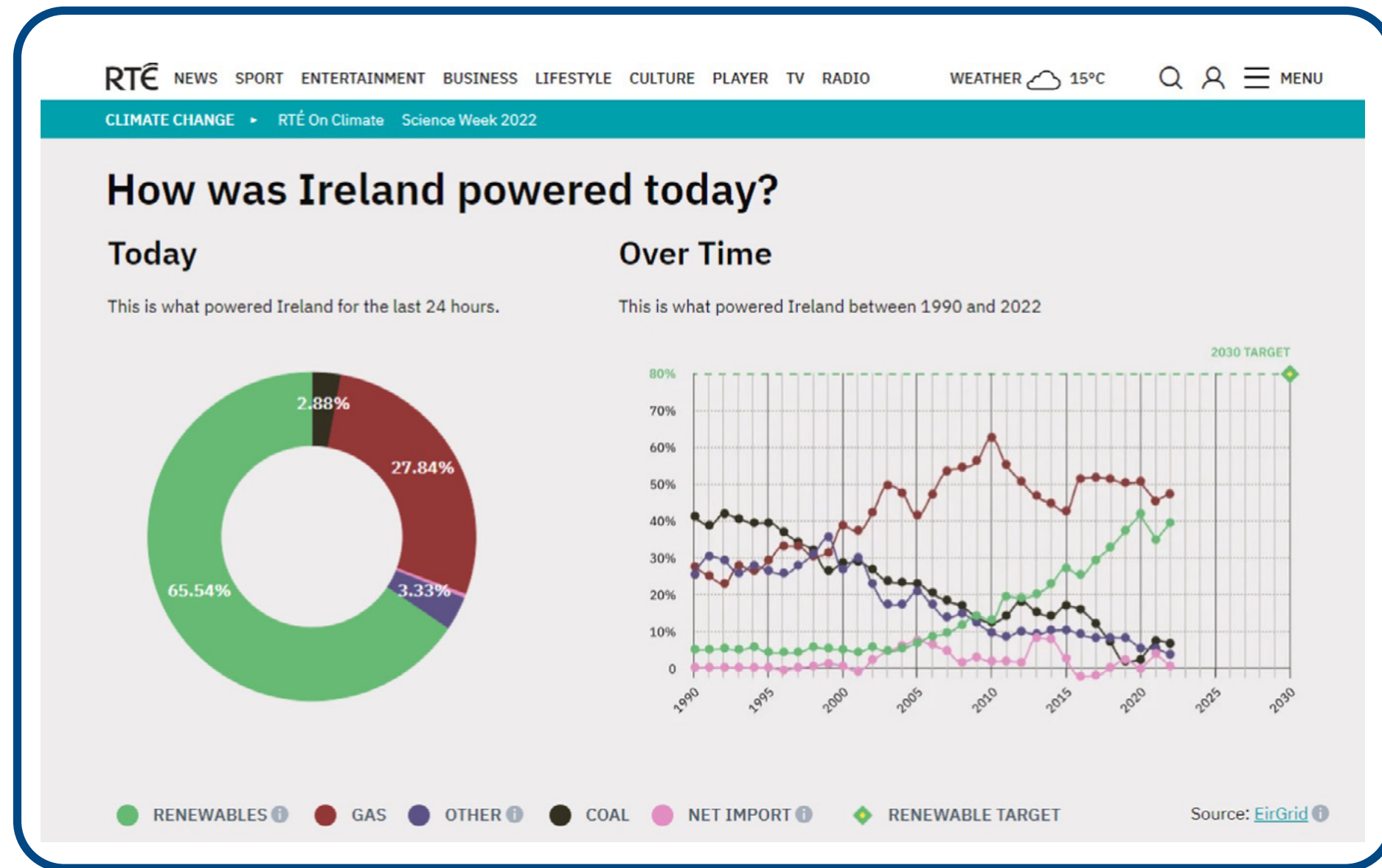
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Discussion

Why is it important to use renewable energy sources?



Discuss the latest figures for energy use in Ireland



Click on the image to get the most up to date figures for energy use in Ireland today.

The data presented will look like this.

- Ireland's aim is to increase the share of electricity generated from renewable sources up to 80% by 2030 – we are currently at 40%, so still a long way to go, and more wind farms needed.

The information is taken from EirGrid and will provide a daily update on the country's progress as it moves from an electricity system powered by coal, gas, oil and peat to one that is powered by clean, renewable generation.

What is a wind farm?

- Wind farm is the term used to describe a group of energy-producing wind turbines located together.
- Wind turbines harness the wind to generate electric power.
- The first wind farm project in Ireland was completed in 1992.
- There are currently over 400 wind farms on the island of Ireland.





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Discussion

Factors influencing the location of wind farms



1. Regeneration of old power stations as renewable power stations

- Ireland traditionally generated energy through burning peat, oil and coal.
- With the growing shift towards more renewable forms of energy generation, many stations generating energy through the burning of fossil fuels have shut down.
- Many former fossil fuel power stations are now ideal sites for generating renewable energy.



Bellacorick Power Station

- Bellacorick Power Station was set up in Northwest Mayo and began operations in 1962. It was located in a cutaway bog, which supplied the raw material – peat – to be burned for generating electricity. The site is near the Oweninny River, which provided water for cooling the waste materials.
- The plant burned approximately 300,000 tons of peat annually.
- The station employed over 100 people and Bord na Móna employed over 250 people on the bog. The power station ceased operations in 2005.

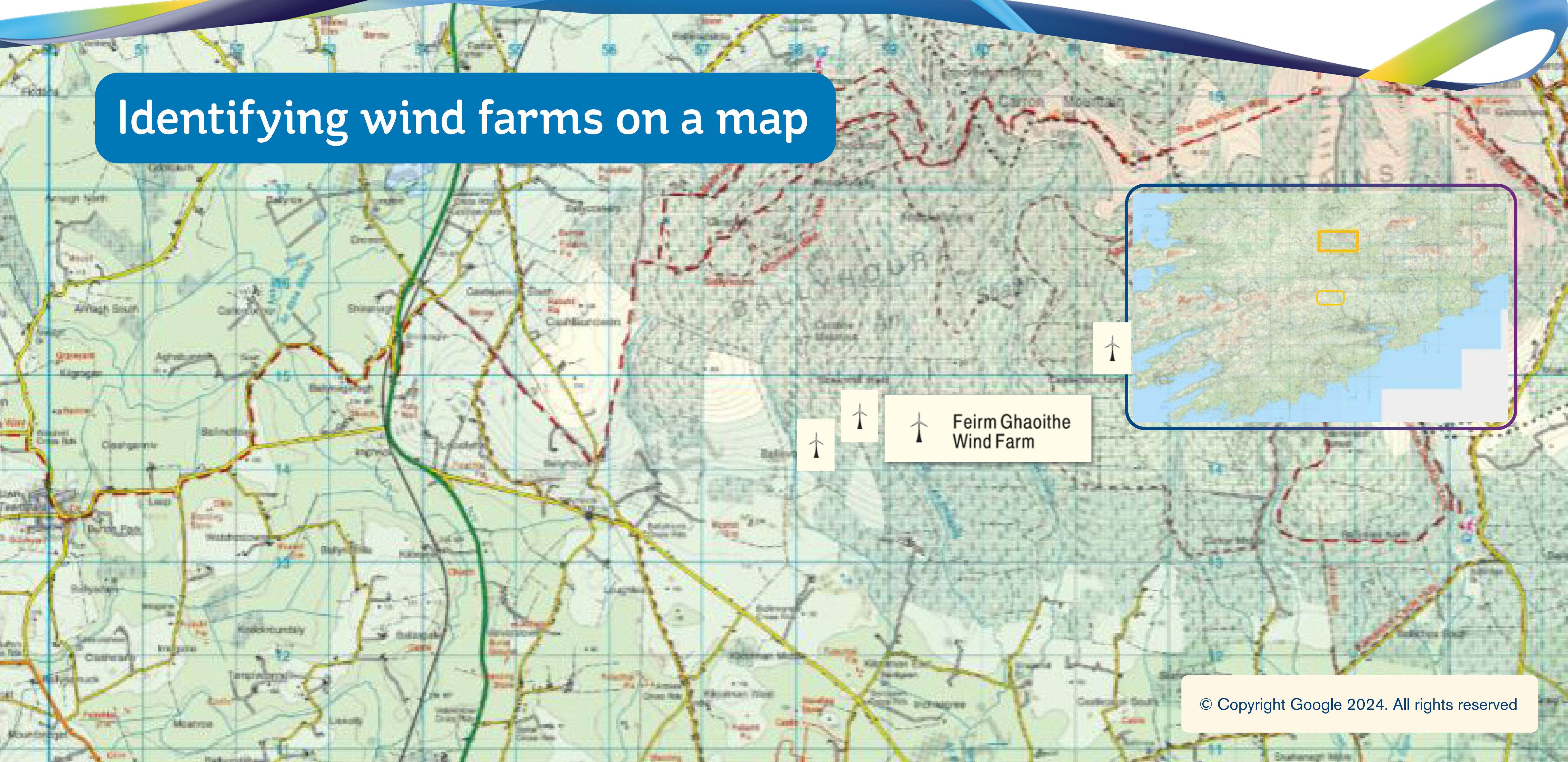


2. Access to wind

- The prevailing wind in Ireland is South Westerly, and many of Ireland's wind farms are on the west coast to take advantage of this prevailing wind to generate wind energy.
- Take a look at this map of wind farms throughout Ireland to see those on the west coast
- Can you find the closest wind farm to your school?

[Link to the map here](#)

Identifying wind farms on a map



Feirm Ghaoithe
Wind Farm

2. Access to wind



- Wind farms can be located onshore or offshore.
- Watch this short video to learn more about onshore wind farms.



3. Gradient

- Looking at the map and the photo it is clear that these turbines are placed on flat land where winds are unobstructed leading to the generation of more wind energy.



4. Good infrastructure

- Good infrastructure is vital in the construction of the wind farm.
- Turbine blades are imported in one piece and are logistically challenging to get into place on site.
- Location considerations may include access to a good road network and distance from a port.



Benefits of wind farms

- Current wind farms are generating enough power to provide electricity to 140,000 homes and business.
- Wind energy produces no carbon emissions, so it has a positive impact on climate change and helps Ireland meet its climate targets.
- Wind farms provides locals with recreational opportunities like walking and biking trails, they also provides an interesting feature on the landscape.

- Wind farms educate people on the importance of renewable energy as many have visitor centres. These wind farms and visitor centres provide employment locally.
- Some wind farms are built on brownfield sites, this is a positive land use change and benefits local wildlife.
- Community funds linked to wind farms can support local initiatives, e.g., sports teams and community groups.

Challenges of wind farms

- Sometimes there may be opposition to the construction of a wind farm due to concerns about potential interruption to phone/radio/television signals or noise.
- Some people think that the wind turbines are an eyesore.
- People may have concerns about whether the blades of the turbines could impact bird populations.
- Some people think that offshore wind farms might contribute to coastal erosion as the sandbanks they are built on provide protection to the coast and people are worried about whether sandbanks might be damaged.

What's the weather like now?

Is it a good time to use electrical appliances?

- Check your Weather Station data – is it windy out now?
- If it's windy, it's a good time to use appliances as wind generates renewable energy and Ireland will be relying on that more and more.



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Class Activity

- In pairs or small groups, imagine you have to choose a suitable location for a wind farm in your county.
Create a short presentation/report with your findings

Consider:

- The location's grid reference/coordinates
- Reasons that this area is suitable for a wind farm
- Identify and address challenges you may face choosing this area
- Benefits of having a wind farm in this area
(environmental/economic/social/political/demographic)



[Link to the map here](#)

1 Take Home Activity - wind turbine detective

a

Find

- **Use this link** to find a wind turbine in your local area or elsewhere in Ireland.

b

Discuss

- Discuss with your guardian why the turbine might have been placed there (consider factors like wind strength or landscape).

c

Findings

- Note down these things: wind turbine location, reasons for this location, one interesting fact about wind energy we learned.



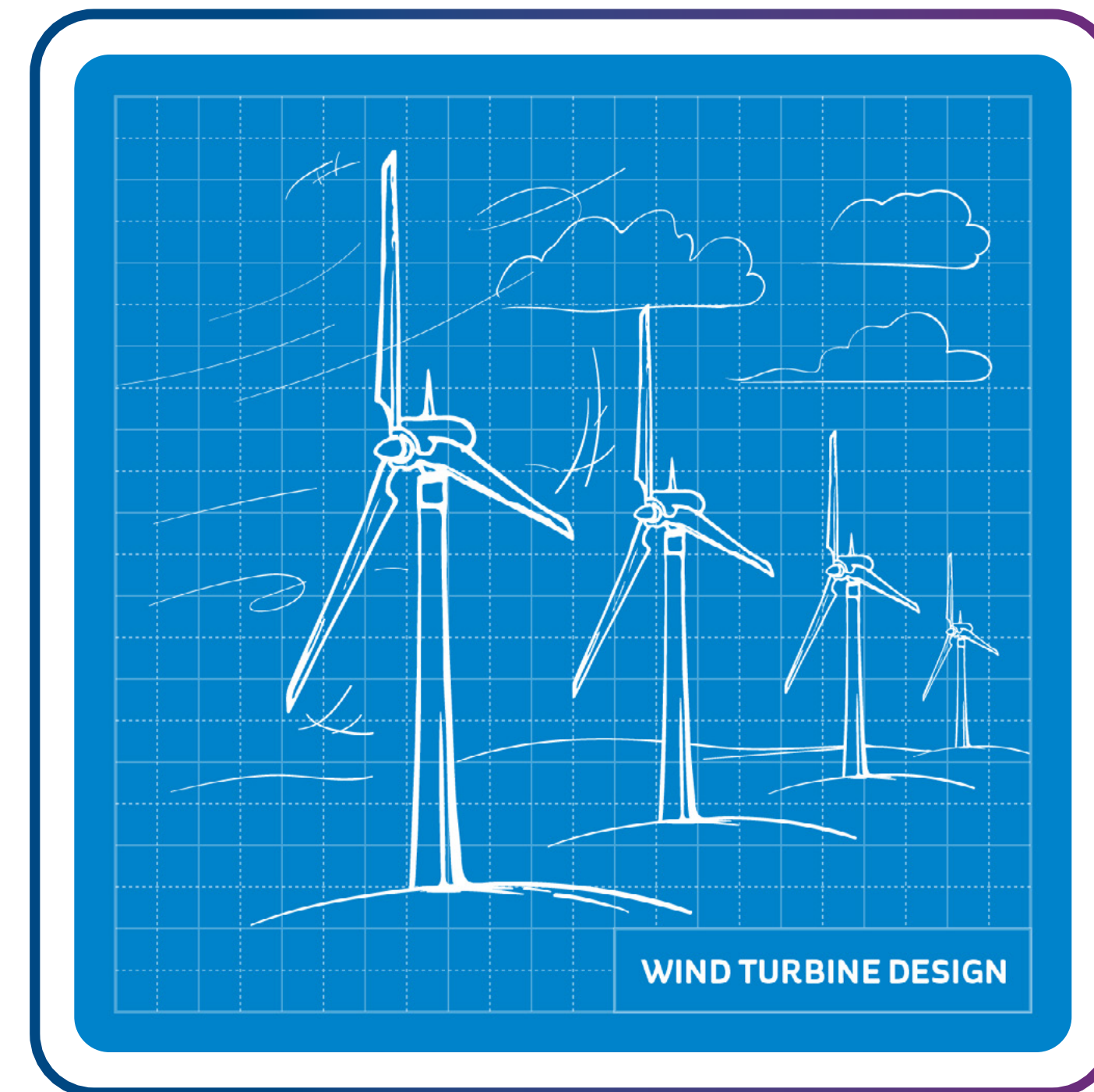
2 Take Home Activity - design or construct a wind turbine

a Create

- Put your knowledge into action and design or make a wind turbine at home!

b Present

- You can be as creative as you like. Bring your design or model into your next class.





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Well Done!

You have completed Lesson 3.

