



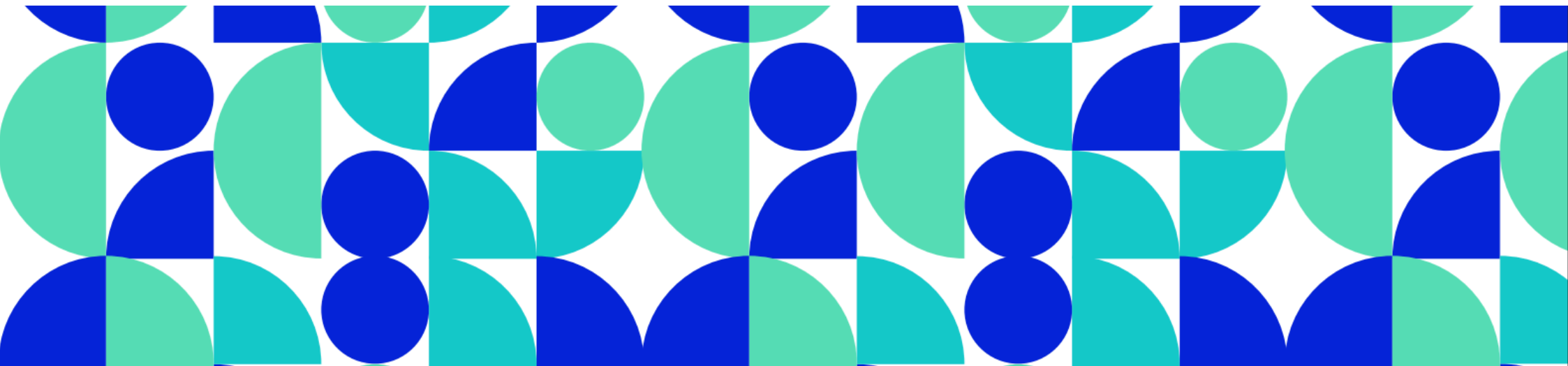
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ACTIVITY CARDS

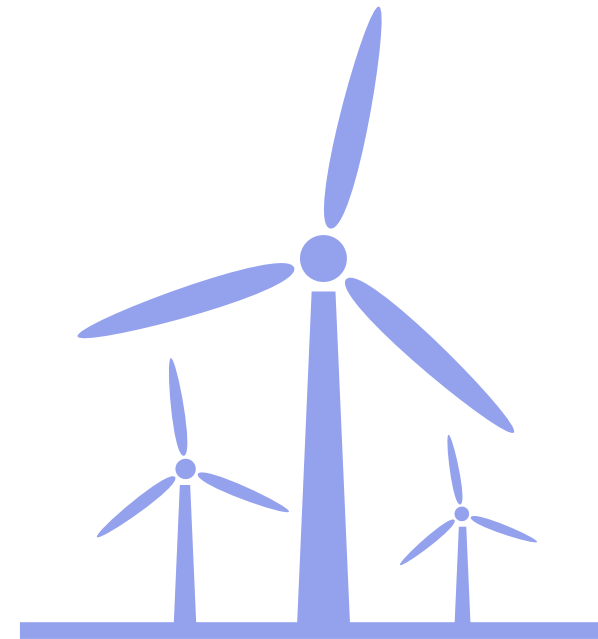
WIND ENERGY LAB

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DIVIDE TASKS

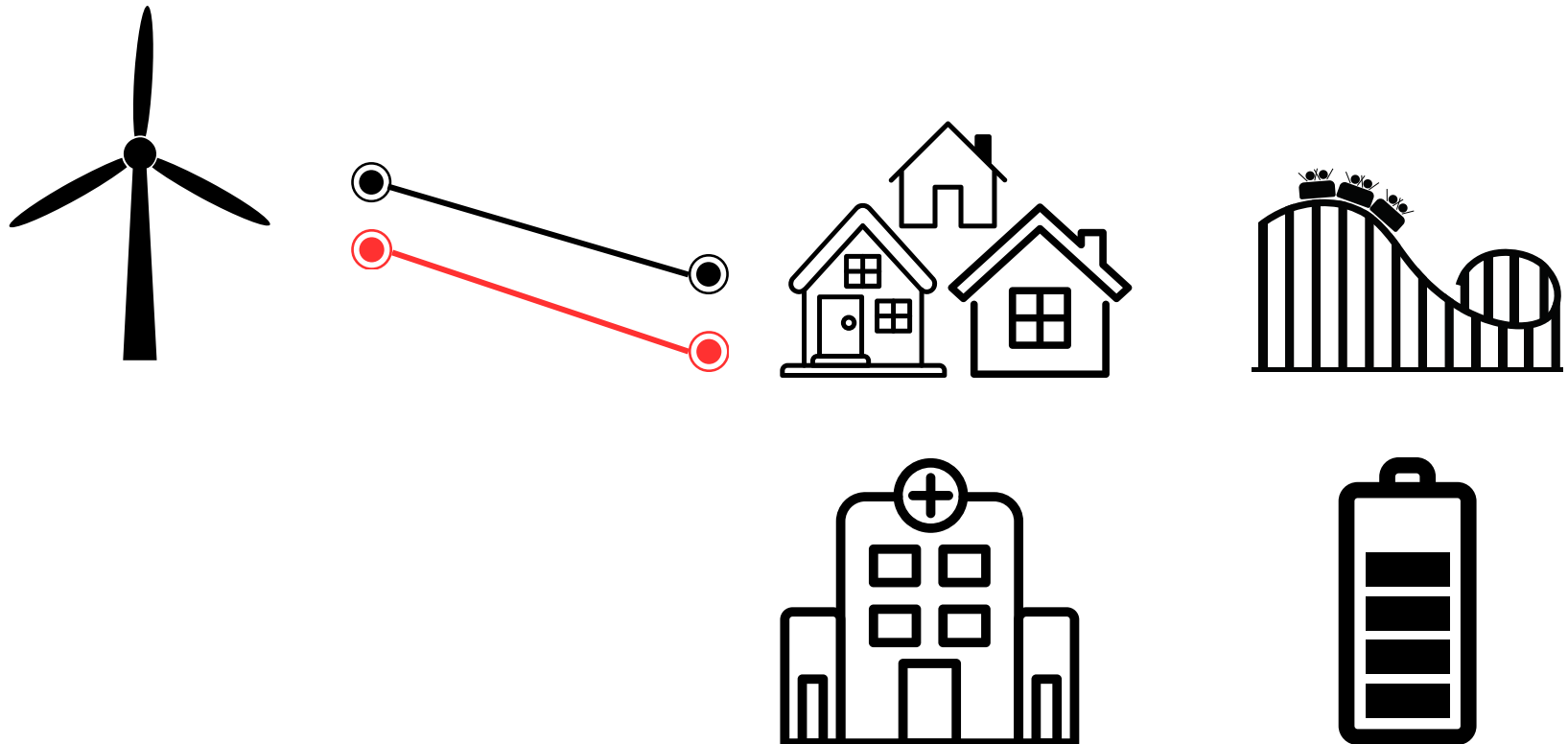
- 1** Decide who will control the wind (fan).
- 2** Decide who will control the lab.
- 3** You may also switch tasks during the activity.



CONNECT THE WIND TURBINE

1

Connect the wind turbine to the different consumers.
Follow the diagram.



MAKE THE WIND TURBINE SPIN

- 1** Turn on the wind (fan) on the lowest setting.
- 2** Observe the wind turbine: is it starting to spin?
- 3** Is the wind turbine not spinning?
Turn up the fan speed one notch at a time.
- 4** Observe: does the wind turbine start spinning?
Is the wind turbine not spinning? Place the fan closer.
- 5** Let the wind turbine spin.

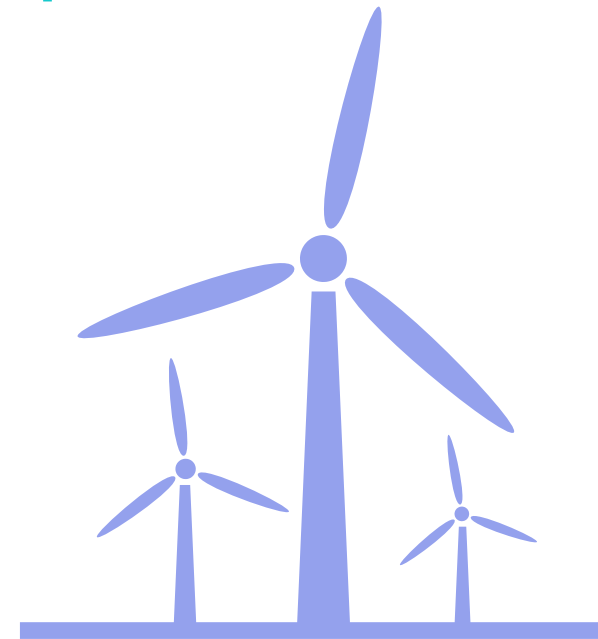
SOLUTION

Wind turbines require a minimum wind speed to start up. If there is not enough wind, the wind turbine does not generate enough energy to set the blades in motion.

In real wind turbines, this is sometimes solved with an auxiliary motor. The motor gives the blades a push until the wind is strong enough to take over.

WHAT HAPPENS WHEN THE WIND DIES DOWN?

- 1** Turn the wind (fan) on at the highest setting.
- 2** Slowly reduce the wind speed by turning the fan down one setting at a time.
- 3** Observe the wind turbine and the voltage on the display.
Does the wind turbine continue to spin at the same speed?
What happens to the voltage?



SOLUTION

When you turn down the fan, the blades of the wind turbine rotate slower and slower. Eventually, it will stop.

This also happens with real wind turbines: if the wind speed is too low, the wind turbine can not generate enough energy.

The wind turbine will switch off automatically to save energy and prevent damage.

HOW MUCH VOLTAGE DOES WIND ENERGY GENERATE?

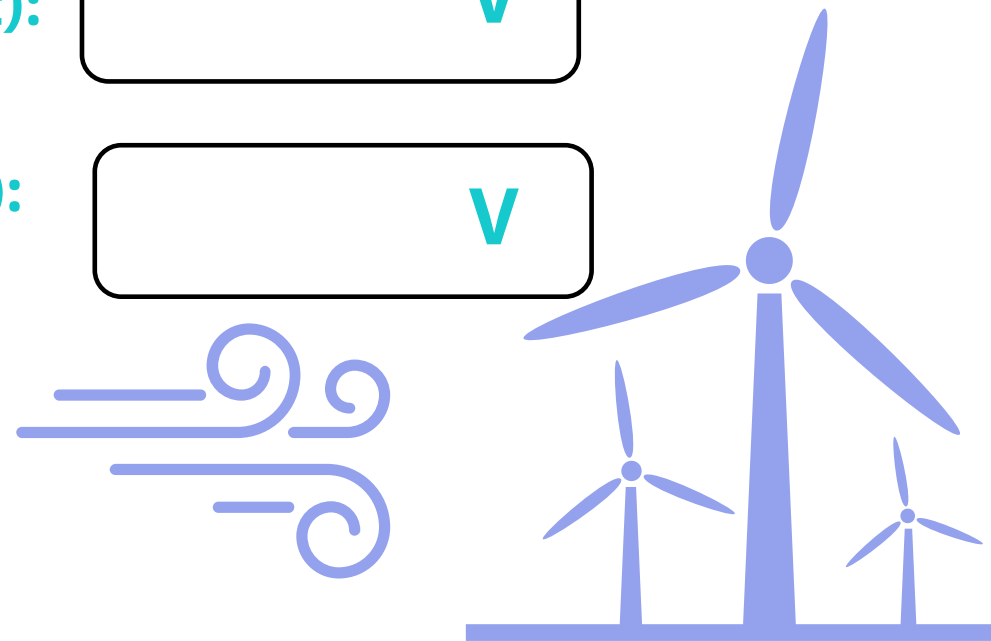
1 Experiment: change the speed of the wind (fan).
Change the direction of the wind by moving the fan.

2 Observe the blades.
What changes?

3 Write down the highest voltage (volt):

 V

4 Write down the lowest voltage (volt):

 V

SOLUTION

The closer the fan is to the wind turbine and the higher the wind speed, the faster the blades turn and the higher the voltage.

Wind turbines work the same way in real life: when the wind is strong, the blades turn faster and generate more electricity.

When there is little wind, the yield is lower.

When the wind direction changes, real windmills automatically turn with the wind. This ensures that the blades are always positioned optimally in the wind to generate as much energy as possible.

WHICH CONSUMERS CAN YOU SUPPLY WITH ELECTRICITY?

- 1** Set the wind (fan) to the position that generates the most voltage.
- 2** Switch on the consumers one by one.
Look at the blue lights.
- 3** Which consumers have enough voltage to switch on?

WHAT IF THERE IS NOT ENOUGH VOLTAGE?

- 1** Switch on all consumers at the same time.
- 2** Observe the wind turbine.
What is happening?
- 3** Observe the blue lights.
What do you observe?
- 4** Is there enough voltage to supply power to all consumers?

SOLUTION

If you switch on all consumers at the same time, the wind turbine will have to supply too much power. This will cause it to slow down and possibly stop completely.

The blue lights indicate whether there is enough voltage. In the event of overload, they will dim or go out.

Real wind turbines also switch themselves off temporarily in the event of overload to prevent damage.

QUESTION?

What other reasons could there be for a wind turbine to stop?

Solution: The wind turbine may stop because there is no wind or because there is too much wind.

WHEN CAN YOU CHARGE THE BATTERY?

- 1** It is evening.
The residential area, amusement park and hospital need electricity.
Switch on the residential area, amusement park and hospital.
- 2** Turn on the battery. Observe what happens.
Can you charge the battery?
- 3** When would be a good time to charge the battery?
- 4** Remove the cables and put them back in the case.

SOLUTION

At night, power consumption is lower, making it easier to charge the battery.

In the evening, more consumers are active (such as the amusement park and the hospital). The wind turbine has to supply more energy, causing the voltage to drop and the battery to charge less efficiently.

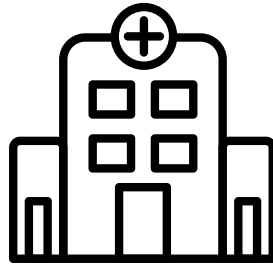
In reality, we also time battery charging with periods of low power demand or high wind. This is called smart energy consumption and is important when using renewable energy.

LEGEND

Consumers



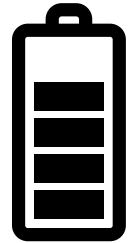
residential
area



hospital



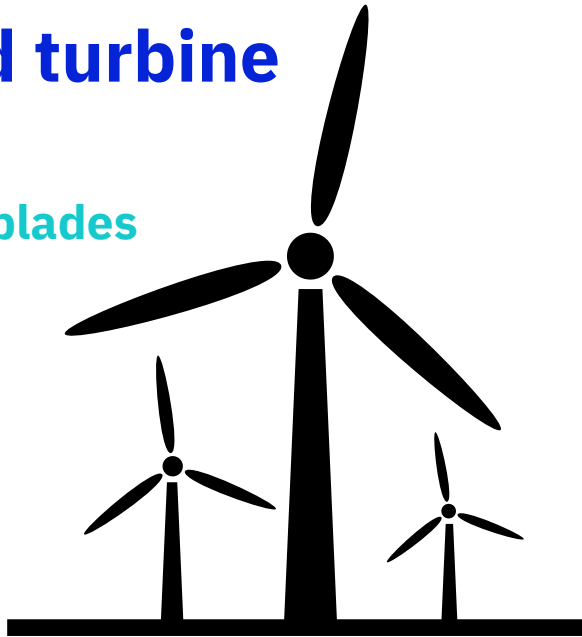
amusement
park



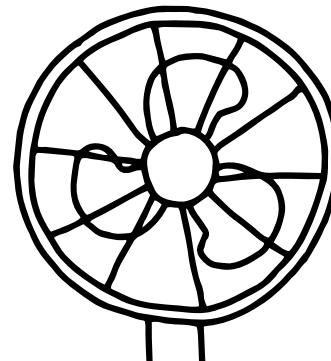
battery

Wind turbine

blades



fan = wind



LEGEND

Voltage (V)

Voltage is like the pressure that pushes water through a garden hose — it's the force that drives electricity through a wire.

Current (Amp)

Current is like the amount of water flowing through the hose — it represents how much electricity is moving.

Power (Watt)

Power is like how strong and far the water sprays out — it depends on both the pressure (voltage) and the flow (current).

The higher the voltage (water pressure) and the greater the current (amount of water), the more power you have to make something work — like a garden hose that sprays farther.