

The Crown Estate Sustainability Initiative The engineering design process

You will learn and understand that wind power is a source of clean energy and be able to design a wind turbine based on an idea from nature.



Reflecting on gameplay

2

1. Where is the activity based?
2. What has happened so far?
3. Who did you meet? What were their jobs?
4. What did you learn about wind turbines?
5. What can you tell me about renewable energy?



Summary

Do now: which statement is false? Circle A, B or C.

Challenge: explain your decisions.

1

- A. Coal is a renewable energy resource
- B. Wind is a renewable energy resource
- C. Solar is a renewable energy resource

2

- A. Fossil fuels include coal, oil and natural gas
- B. Fossil fuels are made from organic material such as plants and animals that has been buried underground for millions of years
- C. Burning fossil fuels does not harm our environment

3

- A. Climate change is caused by burning fossil fuels, farming and deforestation
- B. We can easily solve the issue of climate change
- C. Greenhouse gases include carbon dioxide and methane

4

- A. Wind energy involves the wind turning turbines, that move a generator which transfers it to electrical energy
- B. Wind turbines work all of the time
- C. There are several different designs of wind turbine

1. Which statement is FALSE?

4

- A. Coal is a renewable energy resource.
- B. Wind is a renewable energy resource.
- C. Solar is a renewable energy resource.



Credit: rePower

1. Which statement is FALSE?

5

- A. Coal is a renewable energy resource.
- B. Wind is a renewable energy resource.
- C. Solar is a renewable energy resource.



Credit: rePower



2. Which statement is FALSE?

6



- A. Fossil fuels include coal, oil and natural gas.
- B. Fossil fuels are made from organic material such as plants and animals that has been buried underground for millions of years.
- C. Burning fossil fuels does not harm our environment.

2. Which statement is FALSE?

7

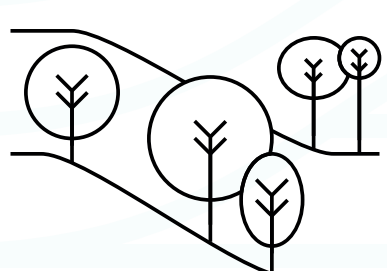
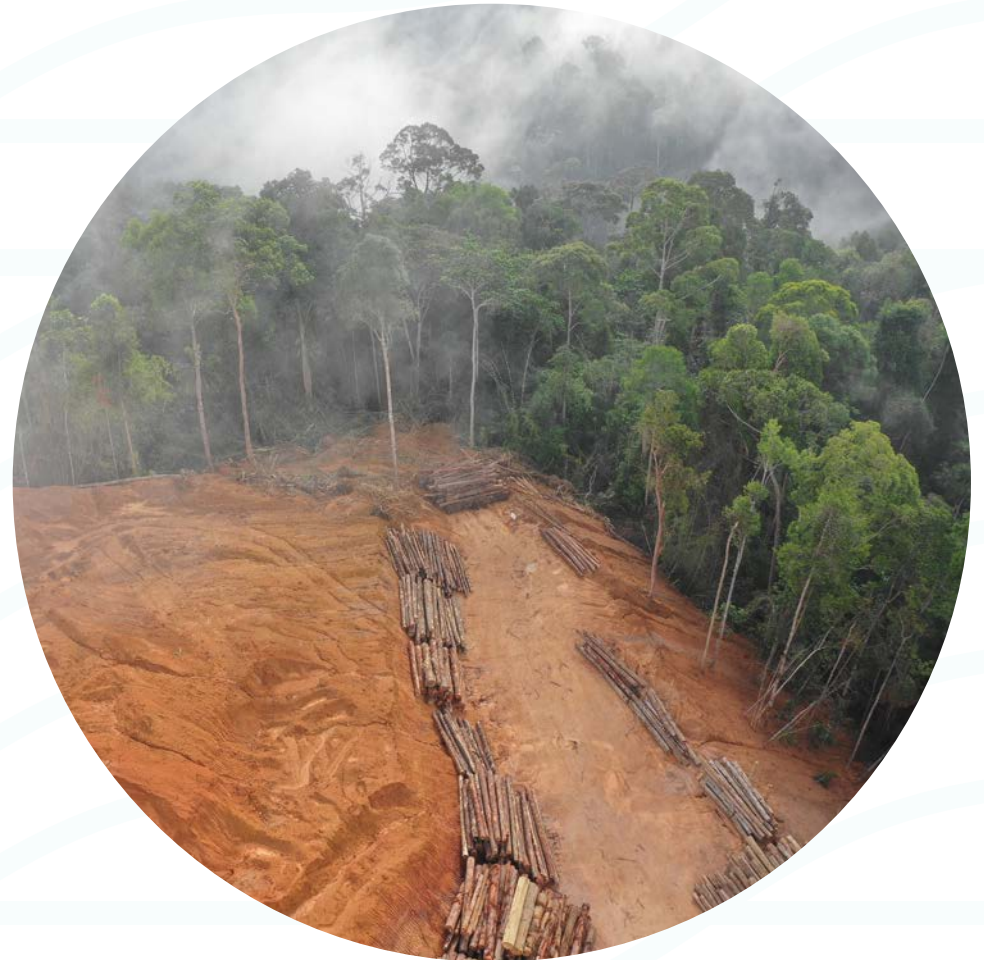


- A. Fossil fuels include coal, oil and natural gas.
- B. Fossil fuels are made from organic material such as plants and animals that has been buried underground for millions of years.
- C. **Burning fossil fuels does not harm our environment.**

3. Which statement is FALSE?

8

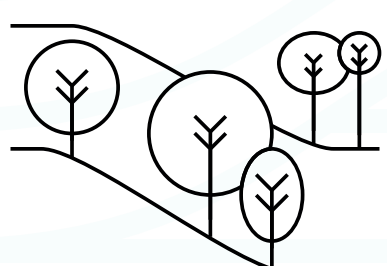
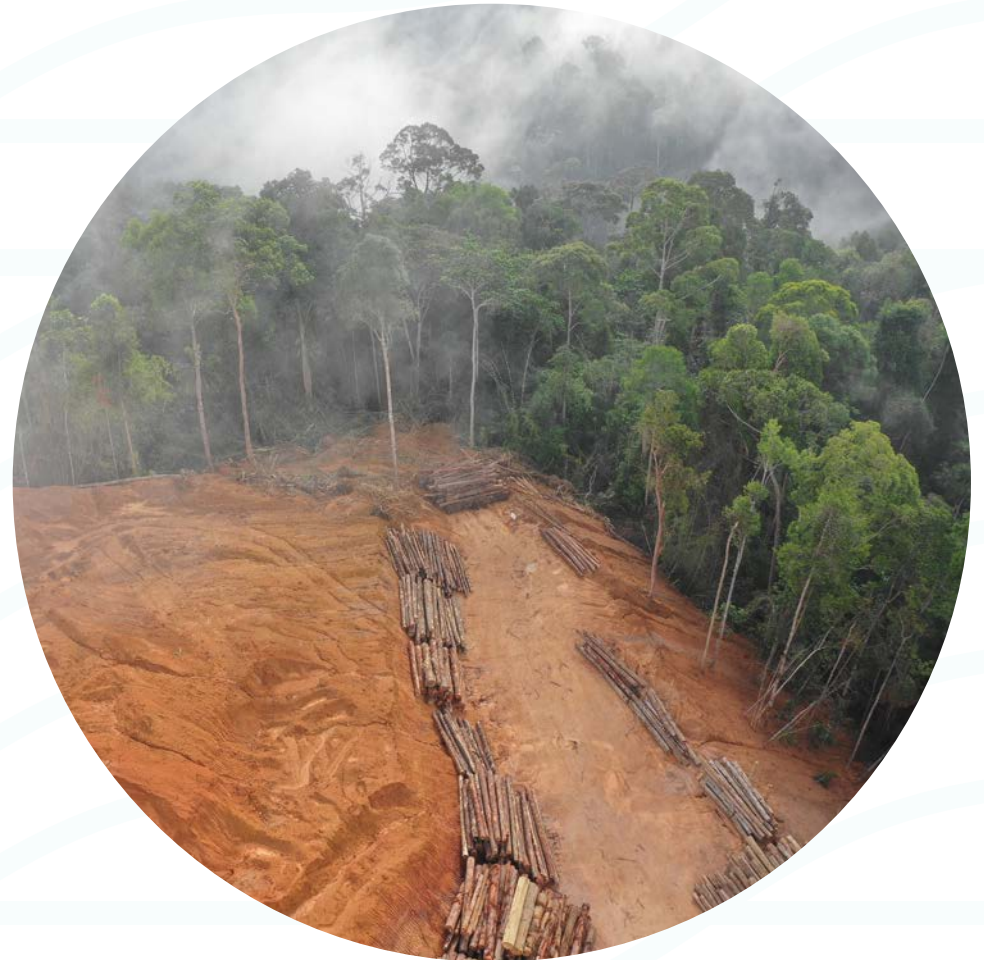
- A. Climate change is caused by burning fossil fuels, farming and deforestation.
- B. We can easily solve the issue of climate change.
- C. Greenhouse gases include carbon dioxide and methane.



3. Which statement is FALSE?

9

- A. Climate change is caused by burning fossil fuels, farming and deforestation.
- B. We can easily solve the issue of climate change.**
- C. Greenhouse gases include carbon dioxide and methane.

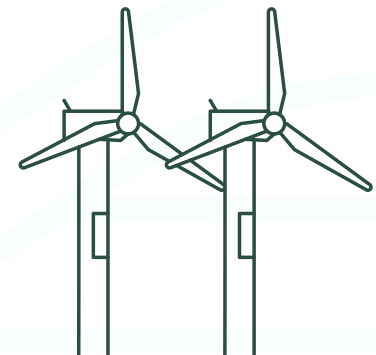


4. Which statement is FALSE?

10



- A. Wind energy involves the wind turning turbines, that move a generator which transfers it to electrical energy.
- B. Wind turbines work all of the time.
- C. There are several different designs of wind turbine.

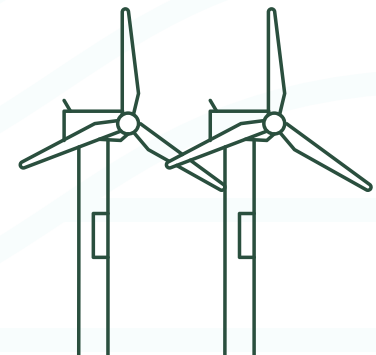


4. Which statement is FALSE?

11



- A. Wind energy involves the wind turning turbines, that move a generator which transfers it to electrical energy.
- B. Wind turbines work all of the time.**
- C. There are several different designs of wind turbine.



Offshore wind

12

- Offshore wind farms play an important role in the generation of clean energy from a renewable source.
- The UK is one of the leading countries in the world for offshore wind, already meeting 8% of the national electricity demand and on track to meet 33% by 2030.
- Surrounded by water, there are many opportunities for offshore wind farms in the seas around the UK.



Offshore wind

13

- When planning offshore wind farms, it's crucial to consider data about species such as birds, fish and marine mammals, habitats, fishing areas and other local activity.
- This helps developers to assess the consequences of offshore wind farms and to reach compromises that respect the environment.

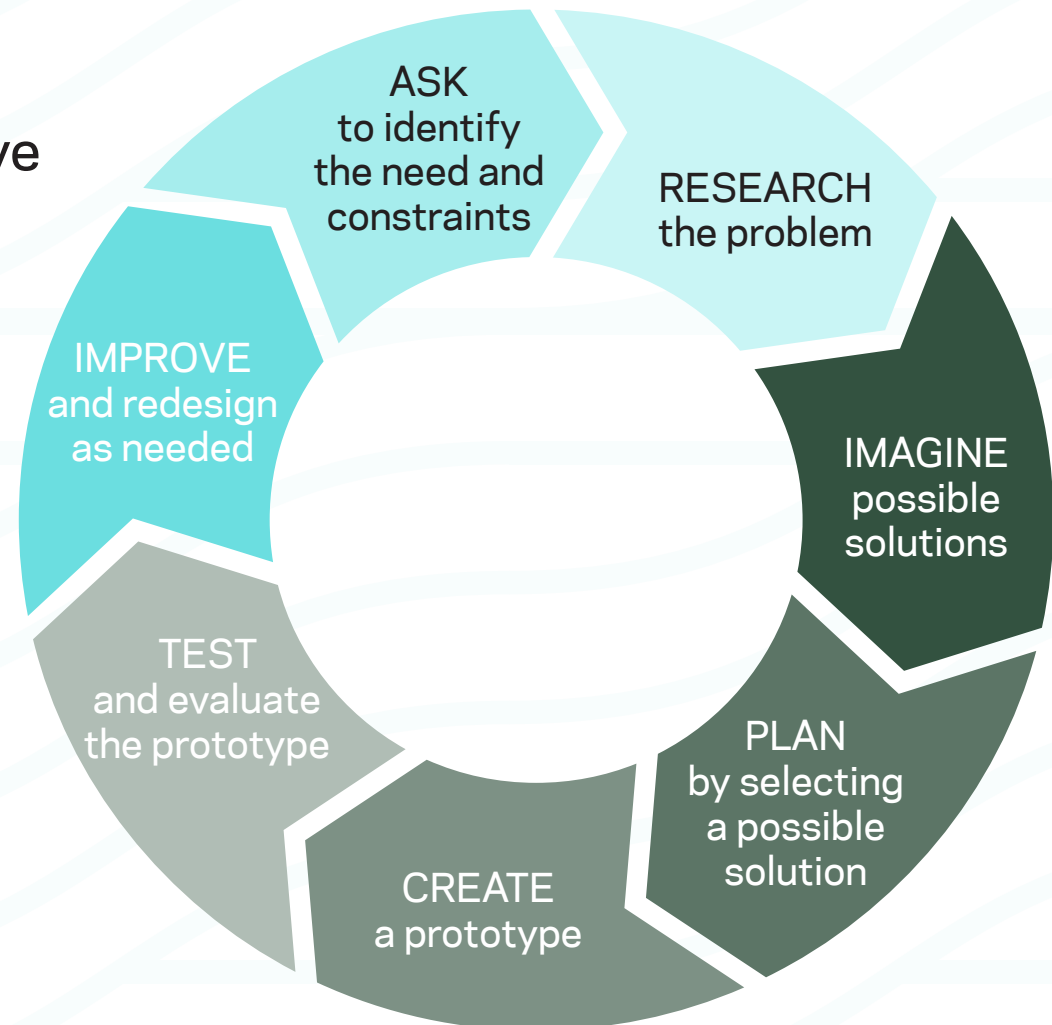


An effective wind turbine

14

How would you engineer an effective wind turbine?

ENGINEERING DESIGN PROCESS



Can we gain ideas from nature?

15

Biomimicry is the imitation of the models, systems, and elements of nature for the purpose of solving complex human problems.

An example is a fast bullet train which was based on a kingfisher's beak.



For a wind turbine, which natural objects move particularly well in fluids such as air or water? Can you think of any ideas from nature that could help design a wind turbine?

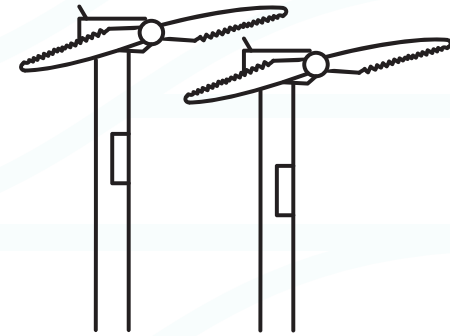


Can we gain ideas from nature?

16

Whalepower Tubercle Technology by The Index Project has a serrated blade which helps cut through the air.

The California Institute of Technology have considered wind farm layouts based on the movement of a school of fish.



Designing your own wind turbine

17



Use the template for your team design

18

THE CROWN
ESTATE

The engineering process
Worksheet

Wind turbine design by:

1. Design Specifications:
Features of biomimicry:
1.

2.

Building materials:

Other features:

2. Draw the wind turbine design and label the specifications.
Challenge: explain why they are needed:

3. Suggested design modifications:

4. Design review:

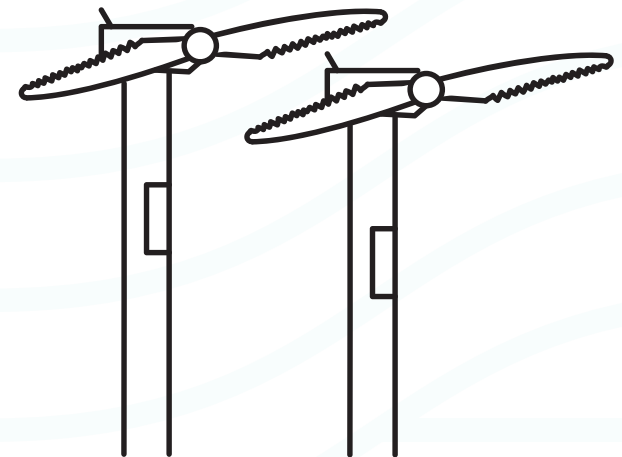
The engineering process: Worksheet

What makes a good wind turbine?

19

Provide feedback on another team's wind turbine – what did they do well and what could they improve?

- Give feedback on the **features of the design**, not the presentation.
- Make sure to justify any feedback with a reason.
- Be specific and kind.



Reflection

20



- A fact / new definition I learned today about wind technology is...
- Something I found challenging was...
- One thing I will do to consider energy use is...

Extension activity

21

Thinking about the design process, write down...

1. Which part of the task did your team find the most difficult and why?
2. What skills did your team use most during the task?
3. How did you all ensure everyone in the team made a valued contribution?
4. How well did your team communicate?

After 5 minutes, you will **share** your answers.

Be ready to provide **feedback** to the class.

HINT

An example might be that you found creative thinking challenging but through communication you managed to suggest some good ideas.

