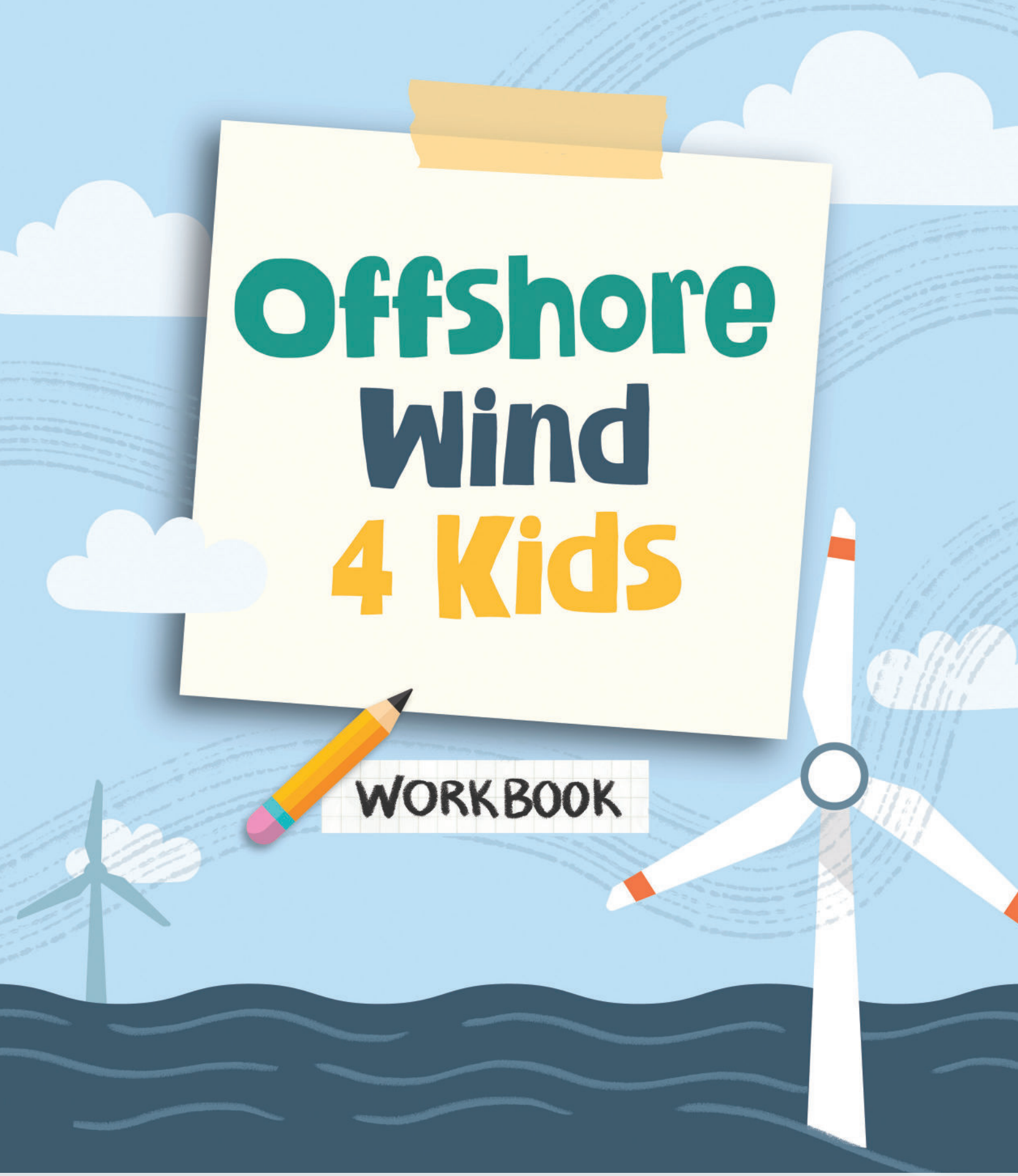
Offshore Wind 4 Kids

WORKBOOK



Offshore Wind 4 Kids

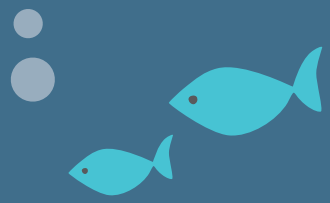
COVE

RBC

NOVA SCOTIA

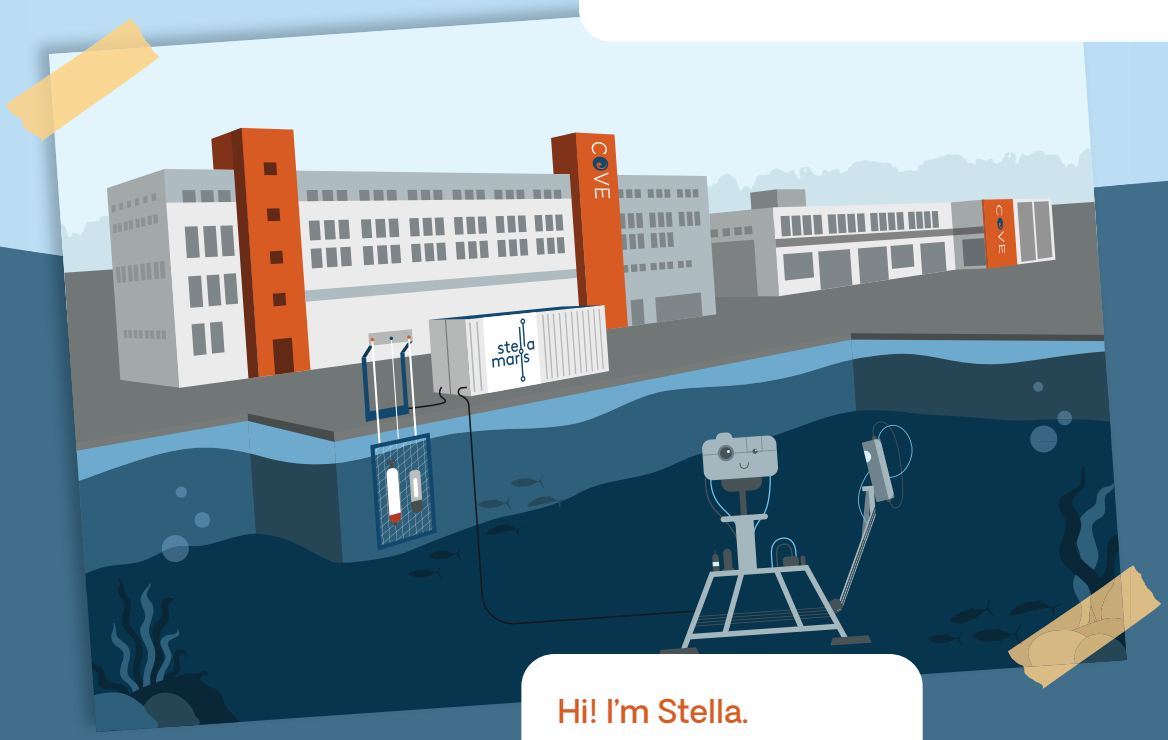
Special thanks to

the Government of Nova Scotia Departments of Natural Resources and Energy, and to the RBC Foundation, for their support in advancing renewable energy initiatives.



What is CoVE?

COVE is an innovation hub that is focused on developing and using innovative marine technology to solve real-world challenges.



Hi! I'm Stella.
Come explore marine technology with me!

Marine Technology Industry

What industries can you find marine technology in?

Marine Transport

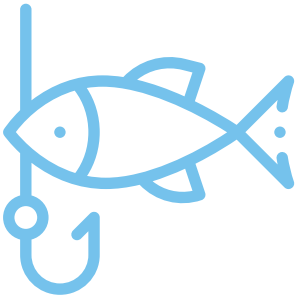
Shipping our Amazon packages back and forth.

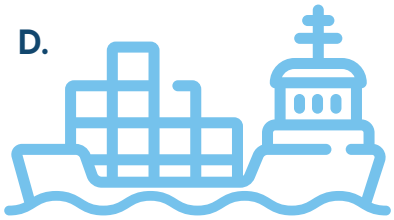
Marine Sectors!

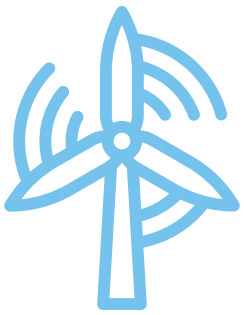
Marine sectors consist of five major industries that work together to explore, utilize, and develop sustainable solutions for our ocean, lakes, and waterways. Match the icons below to the correct industries by drawing them into the blank circles.

A. 

B. 

C. 

D. 

E. 

Marine Defence and Security

NATO, hydrophones, boats, etc.

Fisheries and Aquaculture

Lobster fisheries and growing oysters on farms.

Climate Solutions

Innovative carbon dioxide removal (CDR) methods help reduce climate change and protect marine life.

Energy

Tidal or offshore wind energy.

1. Fisheries and Aquaculture

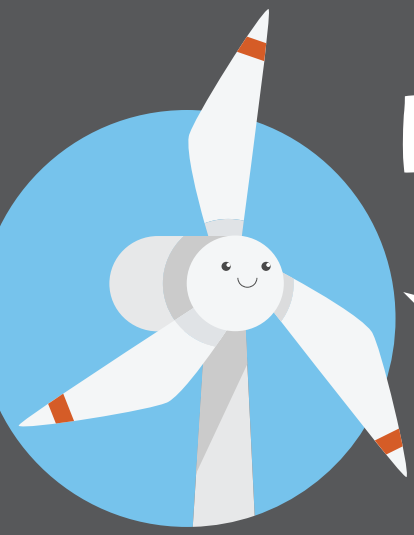
2. Energy

3. Marine Transport

4. Climate Solutions

5. Marine Defence and Security

ANSWERS: 1. C, 2. E, 3. D, 4. B, 5. A



Energy

Energy is the ability to do work, make things happen, and cause changes!

You can get energy from TWO different sources:

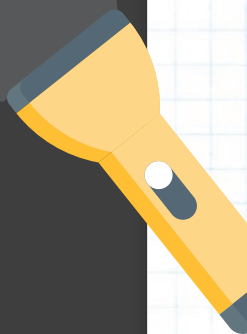
1. Non-Renewable Energy
Comes from a source that will run out or will not be replenished in our lifetimes.

2. Renewable Energy
Comes from a source that is not depleted when used.

Word Search

B E O T K H C G L R N N A V T
N X N C I Z Q O P O K Z K V E
S O Q U D G E H A A R F W U W
G Y N Z C N E Z I L H Q G Z P
R M L R X L A O J B J R L C I
E A W G E S E T T J R M W W F
N Q I Y C N O A U H S K F Q K
E U N B Y L E L R R E O J L A
W S D I I B G W A E A R U N G
A H Y D R O K D A R N L M L C
B W U C V Q M L U B Z E G A M
L V R H O Z Y A F O L E R A L
E K K M R E F H S B R E M G S
R B E D E U K Y A S S M G P Y
D K S J K P B L R B W O I L X

Non-Renewable
Oil
Natural Gas
Coal
Nuclear Energy
Renewable
Solar
Wind
Geothermal
Hydro
Biomass



What Sources of Energy Do We Use in Nova Scotia?

Imports: Energy purchased from another country

Coal: A black or brown rock that, when burned, releases energy into the form of heat.

Natural Gas: A mixture of several gases forming slowly beneath the Earth's surface.

Oil: A liquid found deep underground that is used as fuel.

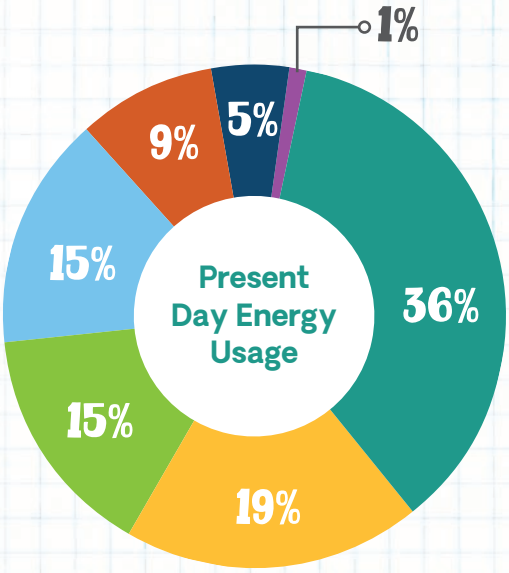
Wind: A renewable source of energy that uses air movement to make electricity.

Hydro: A renewable source of energy that uses the force of moving water to make electricity.

Other Renewable Sources

What energy sources does Nova Scotia use the most?

Match the energy sources with the correct percentages.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Did you know: 80% of our energy is projected to come from renewable sources by 2030?

ANSWERS: 1. Coal, 2. Wind, 3. Oil, 4. Natural Gas, 5. Hydro, 6. Other Renewables, 7. Imports

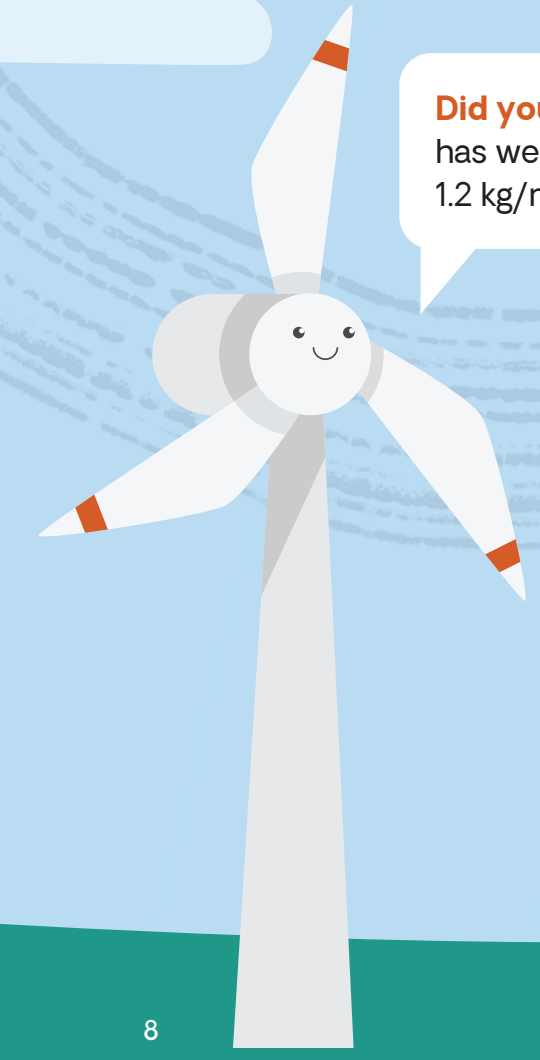
What is Wind?

Fill in the Blanks

1. Wind is _____which is in_____.

Word Bank

Air	Movement	Fire
Earth	Rest	Pause



Did you know that air has weight? It weighs 1.2 kg/m3!

Wind and Power Produced

Fill in the Blanks

2. As the_____of the wind_____,

the amount of power made_____.

Word Bank

Hint: The words in the word bank can be used twice!

Speed

Movement

Increases

Decreases

Stays the same

ANSWERS: 1. Air, Movement, 2. Speed, Increases, Increases

What is a Wind Turbine?

Parts of a Wind Turbine

Blades: Each turbine has 3 to 6 blades. These catch the wind and allow the rotor to start rotating.

Rotor: A part of the rotating part of the turbine; three blades are attached to it.

Nacelle: A large metal structure that holds all of the parts that produce power, ex., generator.

Shaft: A 'stick' that transmits mechanical energy from the rotor to the generator.

Tower: This structure, made of round steel tubes, supports the nacelle and gives the turbine most of its height.

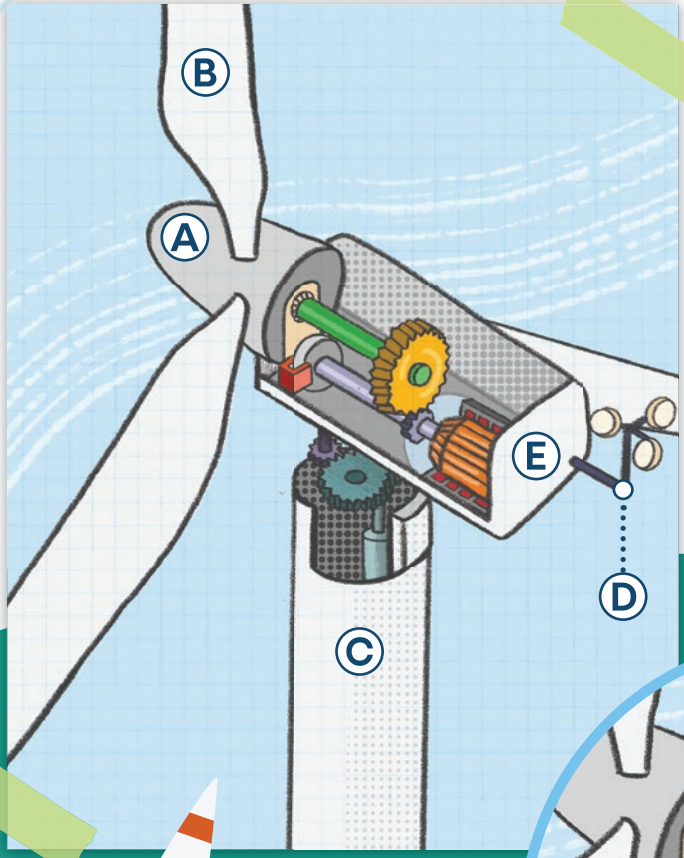
Controller: The computer that controls the pitch angle of the blades and the orientation of the turbine into the wind.

Generator: This changes the mechanical energy of the rotor into electrical energy.

Anemometer: Attached to the controller, which measures the wind speed.

Time to Label a Turbine!

Let's learn about the different parts of a wind turbine that work together to produce power! Use the word bank to help you label each part.



A. _____

B. _____

C. _____

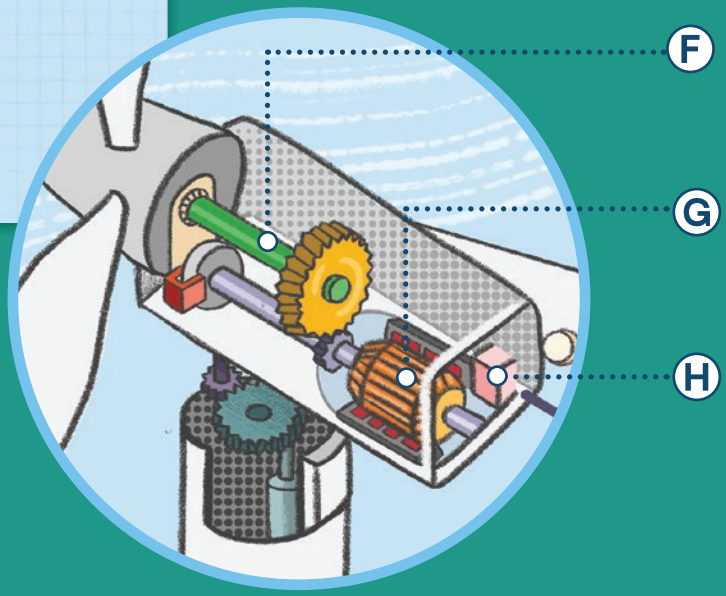
D. _____

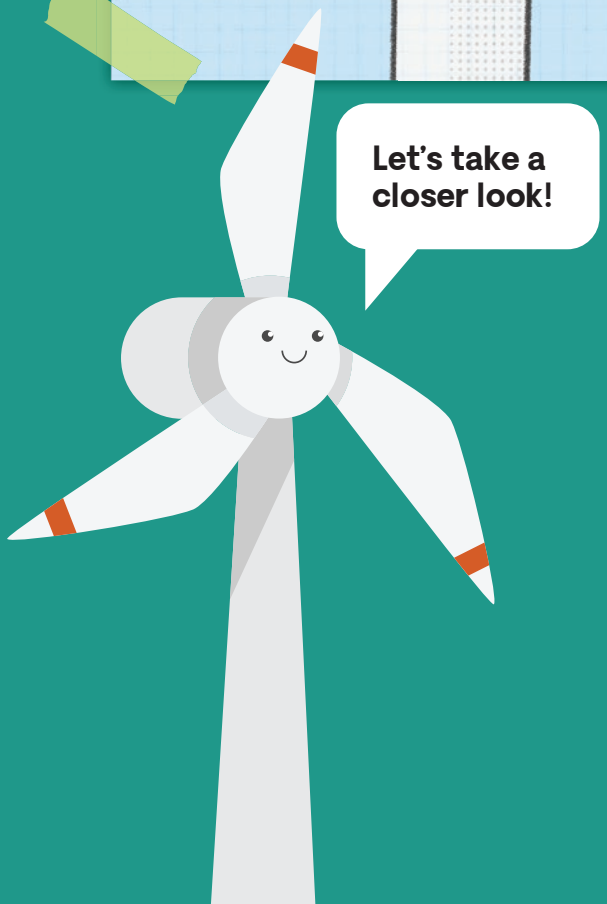
E. _____

F. _____

G. _____

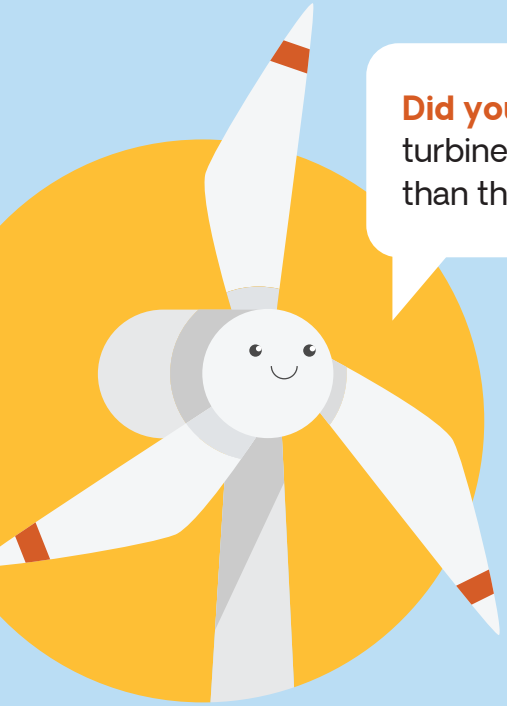
H. _____



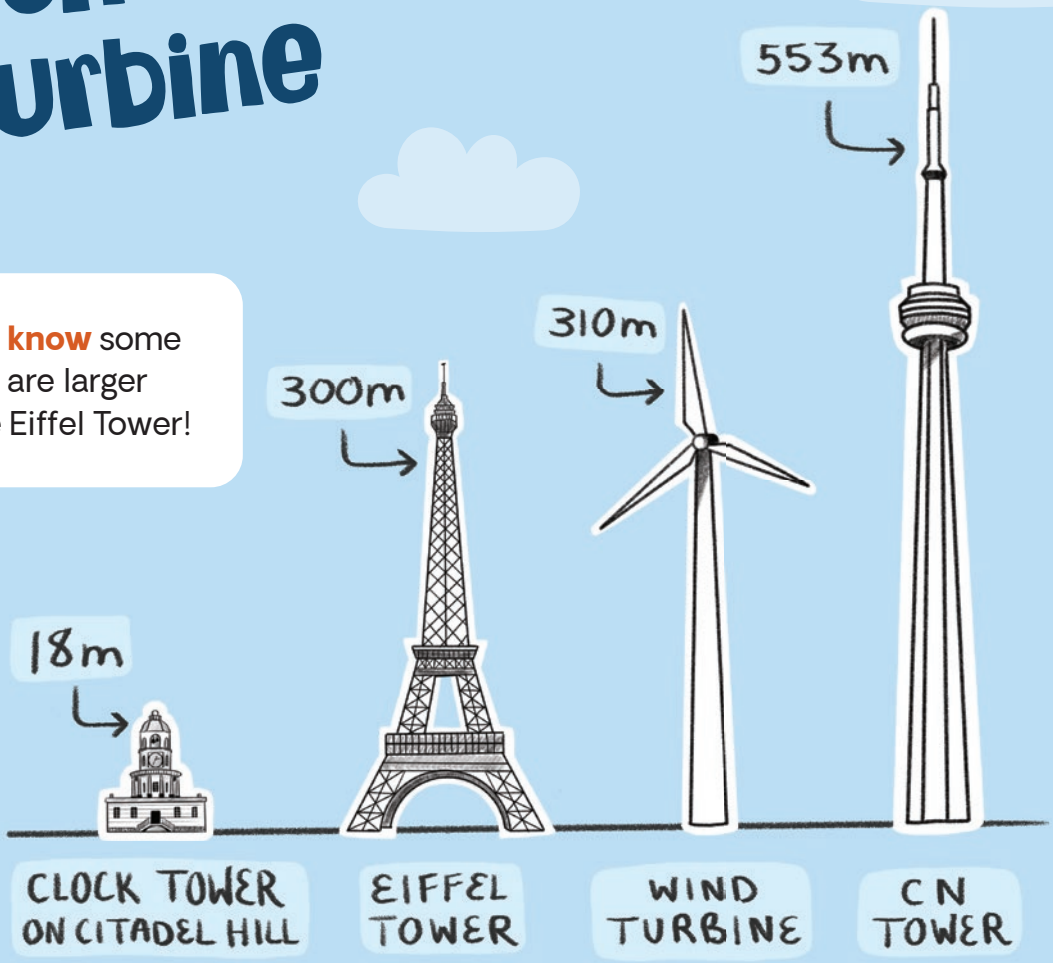


ANSWERS: A. Rotor, B. Blade, C. Tower, D. Anemometer, E. Nacelle, F. Shaft , G. Generator, H. Controller

Evolution of a Wind Turbine



Did you know some turbines are larger than the Eiffel Tower!



Nova Scotia plans to start building Canada's first offshore wind farms by 2030!

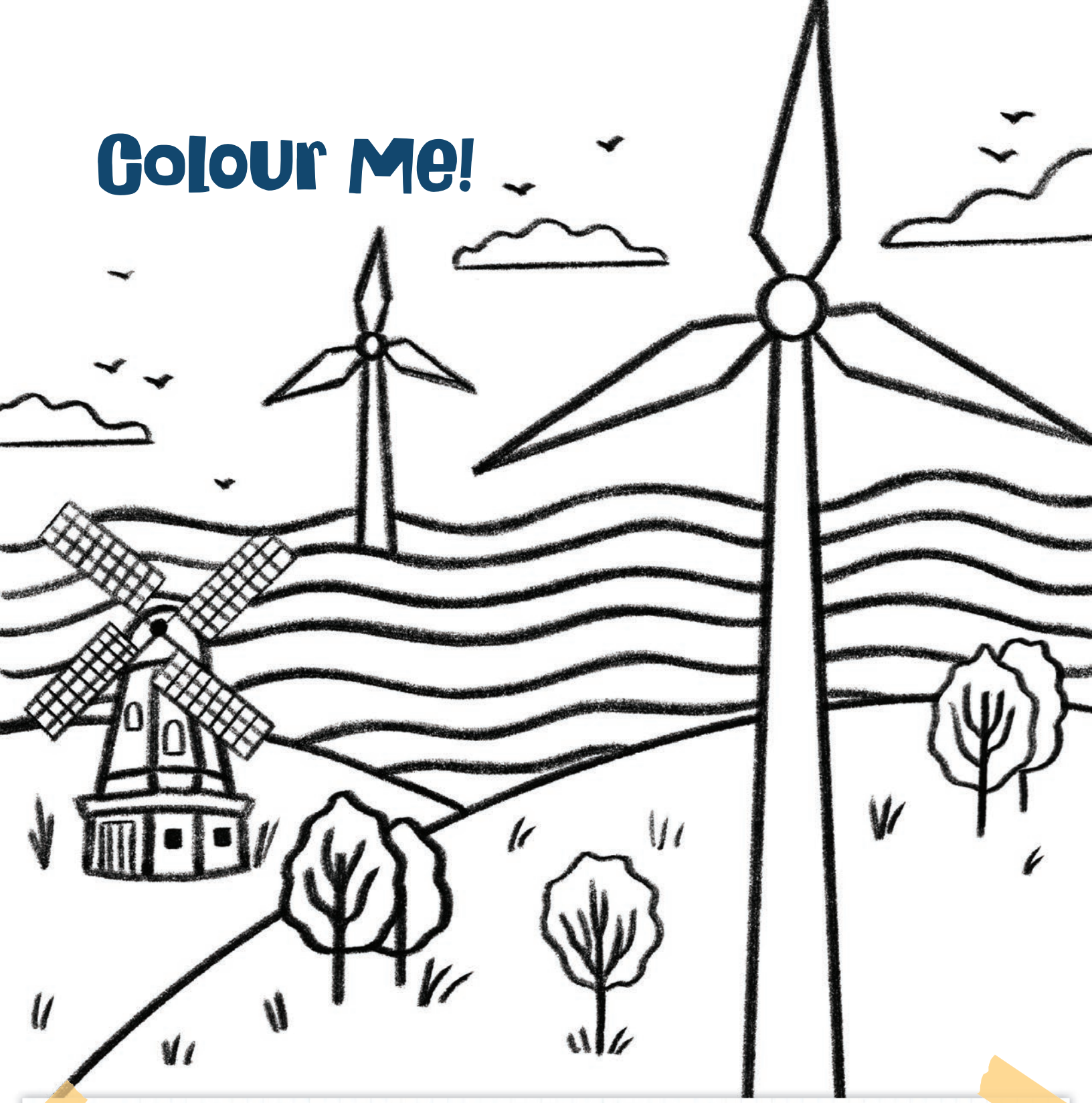
The **UK** has the largest amount of offshore wind turbines in Europe!

Denmark had the first offshore wind turbines!

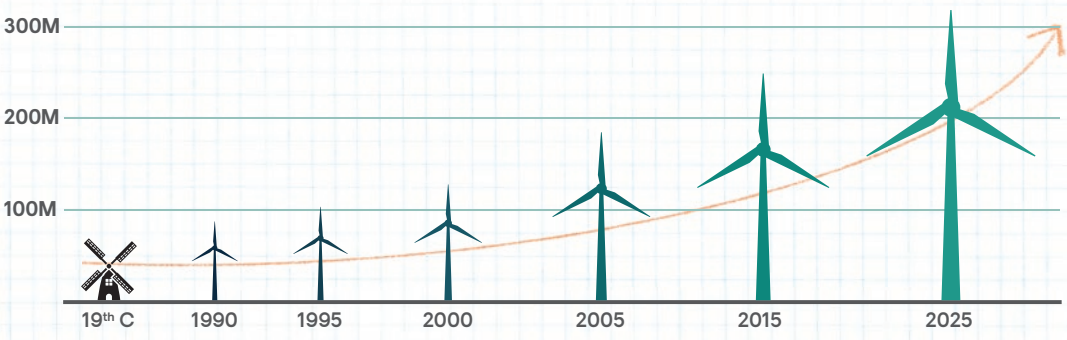
China has the largest amount of offshore and onshore wind turbines!

Belgium is where OffshoreWind4Kids is located!

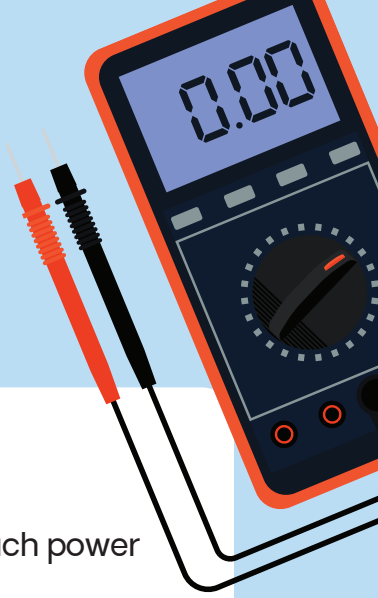
Colour Me!



Wind turbines have not always been so tall! They started out under 100 m and have gotten **bigger** as technology has improved.



How to Measure Electrical Power



Fill in the Blanks

1. Turbine technicians can use a _____to measure how much power a wind turbine produces.

2. A multimeter measures _____and_____, which, when multiplied, tells you how much _____you are producing.

3. We measure power as it can let us know how much _____ we are consuming – this allows us to see any issues with our turbine and work to improve how much_____ it produces.

Word Bank	Voltage	Multimeter	Power
	Electricity	Energy	Current

Match the Definition

Draw a line connecting each word on the right to it's correct definition on the left.

A. Electricity

B. Power

C. Energy

D. I=Current

E. V=Voltage

1. The ability to do work or make things move, machines go, and living things grow.
2. A form of energy that can give things the ability to move and work.
3. What makes an electric charge move. The "push" that causes electricity to move in a wire measured in the unit of Volts (V).
4. Is the movement of an electrical charge over time measured in the unit of Amperes (A).
5. The rate at which energy is used, Aka a measurement of how fast you use energy.

Calculate Electrical Power

Electrical power measures how much energy is used in a circuit and is calculated using the formula P = V × I, where power (P) equals voltage (V) times current (I). The higher the voltage or current, the more power a device uses, helping us understand energy efficiency and electrical performance.

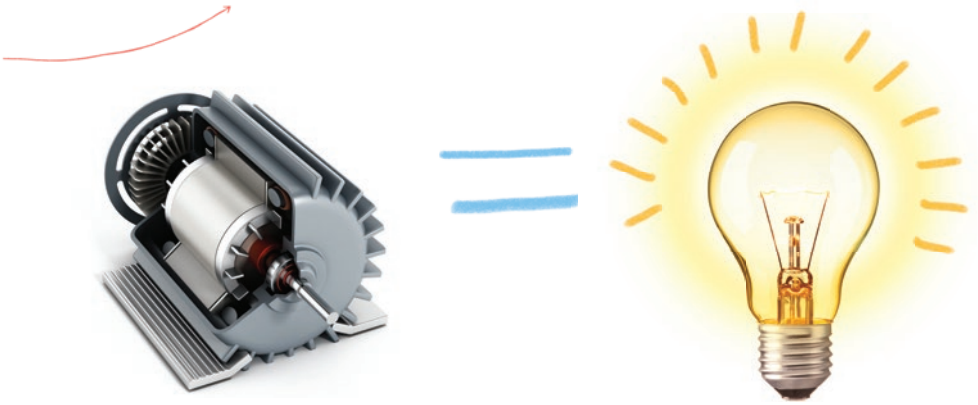
Electrical power (Watts-W) = Voltage (V) x Current (I)

1. V1 x I1 = 4 V x 2 A =_____

2. V1 x I1 = 5V x 3 A =_____

Did you know?

The rotation of the magnet inside the generator is what produces power!



ANSWERS: Fill in the Blanks: 1. Multimeter, 2. Voltage, Current, Power, 3. Energy, Electricity, Match the Definition: A to 2, B to 5, C to 1, D to 4, E to 3
Calculate Electrical Power: 1.8W, 2.15W

Offshore Wind Turbines

What are the two main reasons we want offshore wind over onshore wind?

1. There is a lot more _____in the ocean.

2. There are higher_____, which produce more _____than it would on land.

Word Bank	Power	Sound	Wind Speeds
	Waves	Space	Turbines

Fill in the Blank

Which wind turbines are **FIXED** and which are **FLOATING**?

a. Spar Buoy

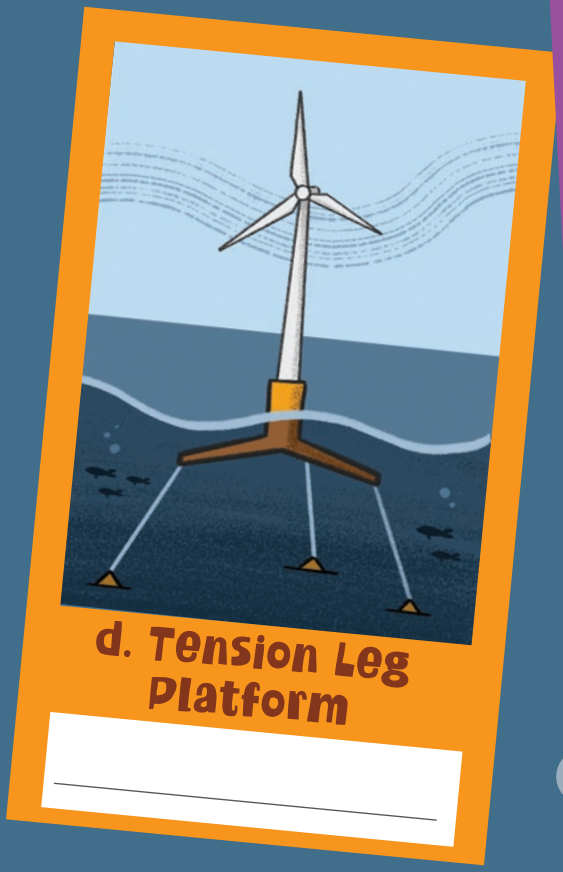
b. Monopile

c. Gravity Based

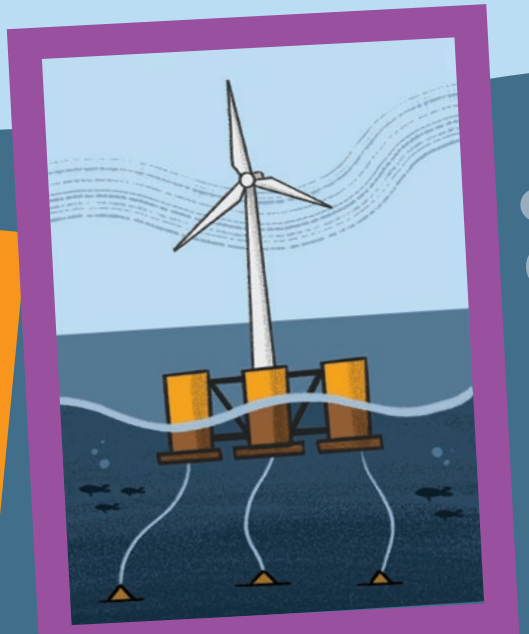
Different Types of Offshore Wind Turbines

FIXED Offshore Wind Turbines: We normally build fixed offshore wind turbines in shallow waters (< 60 m depth). Fixed to the bottom of the ocean floor by a support structure.

FLOATING Offshore Wind Turbines: In deeper waters, floating structures are ideal and can open many areas worldwide for development. The turbine is put on top of a floating structure which is kept in place by anchors.



d. Tension Leg Platform



e. Semi-Submersible

f. Jacket

ANSWERS: 1. Space, 2. Wind Speeds, Power
A. Floating, B. Fixed, C. Fixed, D. Floating, E. Floating, F. Fixed

Careers in Offshore Wind

WIND TURBINE TECHNICIAN

Technicians perform technical tasks with their hands to keep wind turbines functioning correctly. Some of these tasks can include fixing the wiring, checking in on the gears, and measuring the electricity produced. To become a wind turbine technician, you can attend community college (College of the North Atlantic). You can also become a technician with work experience in the trades (e.g., electrician and mechanic).

ELECTRICAL ENGINEER

Responsible for understanding how to design and operate all the various electrical components needed to make wind turbines work. You can become an engineer by attending university (e.g., Dalhousie, Acadia. St. FX, etc.).

WELDER

Use specialized tools to “weld” or join various metal components that are used to build wind turbines. You can become a welder by attending community college (e.g., NSCC, NBCC).

BIOLOGIST

Studies the impacts of offshore wind turbines on local birds and marine life. Commonly used for environmental assessments. You can become a biologist by attending university (e.g., Dalhousie, Acadia, St. FX, etc.).

DRONE PILOT

Many offshore wind turbines are too tall to send someone up to check on them constantly. Therefore, drones are used to fly over to look at the turbine's condition. You can take an online exam to get certified as a drone pilot.

ROPE ACCESS TECHNICIAN

Are in charge of attaching themselves to the turbines with ropes and climbing up the structure to do maintenance. No certifications or previous education is needed.

Word Search!

Z J W T Q G V D K T B J Y G U I R O U M
F K E A A D O B R J L Q E T K X O N Z K
N B I O L O G I S T T E V I L V P S L U
G L N I J B M Q I P N D L A K B E I G L
B B R M W M Y L L N D B B Z R J T Z V D
T E O K E U V U G S G I H U G Q E F N W
K X G L L U I X T Q S M C X S D C F I I
K L V G D L E F G P P X D A V N H I V N
D R O N E P I L O T B O D X E S G A N D
F S C Y R M J V Z K F M Z A D S T N R T
M R S K L E H A M V Z L S D A H S P O U
I E B M J Q Q S Q J A D U A Z R I B Y R
N E L E C T R I C A L E N G I N E E R B
E X O W M B W T V J K D L P C K H C Y I
O Y V Z P K S P E Z K J U T Q H T B X N
Y G T H Y Y G T L Y W F C J N E W O J E
K A G P H R J P K I A T V Y K I M B I T
B J H M G S C S S P G V V W J X S D L E
T A U O A L U F X H T R N M V S U Y E C
P L S V Q U D G O G C A S B I D R S Y H

Wind Turbine Tech
Electrical Engineer
Biologist
Drone Pilot
Welder
Rope Tech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