



FLORES

Offshore Renewable Energies
partnership in the Pact for Skills

Educational Materials for the Offshore Renewable Energies

Secondary School Guidebook

Lesson 2: Wind energy

2



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About this guidebook

Forward Looking at the Offshore Renewables (FLORES) will promote the core activity of the Large-scale partnership launching the Pact for Skills in the Offshore Renewable Energies (ORE) sector. FLORES will support the most committed stakeholders in the ORE, underpinning the success of the offshore renewable energy strategy with the stimulation of dedicated training offers. The partnership will promote the skilling process for the new jobs expected in the sector, estimated to account for between 20,000 and 54,000 new workers in the following five years and contribute to improve upskilling opportunities in the field of the actual ORE workforce.

FLORES prepared a set of educational materials for secondary school teacher presenting six topics:

- 1) introduction to offshore renewables;
- 2) wind energy;
- 3) solar energy;
- 4) ocean currents energy;
- 5) wave energy;
- 6) tidal energy.

For every lesson there is a guidebook and additional sources as well as a PowerPoint presentation aimed at developing practical Science, Technology, Engineering and Mathematics (STEM) experiences for secondary school students.

The objective of these educational materials is to empower teachers to introduce offshore renewable energy as a new topic and seamlessly integrate ocean literacy into their lessons. It is a «teach the teacher» resource that equips educators with the methodology required to independently craft lesson plans, while also providing them with a curated selection of existing resources.

This guidebook is aimed at students in secondary school, and the content can be adapted to younger and older students ranging from 12-18.

Project duration: January 2023 – December 2024 (24 months)

www.oreskills.eu

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Guidebook



Offshore renewable energies: wind energy

This document is intended for secondary school teachers and serves as a guide for lessons introducing wind energy as an energy source.

 45' - 60'	<p>Duration: approx. 45-60 minutes</p> <p><i>Lesson time can be extended with the use of additional materials provided under the scenario.</i></p> <p><i>Given the amount of information and number of Slides, this lesson can be divided into 2 sessions.</i></p>
	<p>Target group: secondary school pupils</p>
	<p>Learning objectives:</p> <ul style="list-style-type: none"> ▶ To familiarise students with the definition of offshore wind energy. ▶ To explain how a wind turbine works and what components offshore wind turbine is made of. ▶ To understand how offshore wind farm works. ▶ To learn about the advantages of using this type of energy and what are the main drivers. ▶ To present where the best offshore wind conditions are and where investments are geographically located.

Competencies and skills to be developed:

- ▶ Ability to define offshore wind energy.
- ▶ Ability to identify and compare technological solutions of offshore wind turbine foundations.
- ▶ Ability to present the advantages and drivers of offshore wind energy.
- ▶ Ability to transform information about offshore wind energy into logical and understandable conclusions.
- ▶ Ability to express opinions on the determinants of development of offshore wind energy.

Proposals for evaluating learning outcomes (elective):

- ▶ Evaluation of students through their activity in discussion and participation in group tasks.
- ▶ A short quiz to test students' understanding of offshore wind energy.

Including diversity and inclusive aspects in teaching:

- ▶ During the lesson, the teacher should pay attention to the different perspectives and approaches of the students towards offshore wind energy.
- ▶ Encourage open discussion and respect for different points of view.
- ▶ Enable students to conduct their own research and experiments to explore a topic according to their individual interests.
- ▶ Sensitivity to the needs of students with different religious beliefs, gender, disabilities, ensuring that they have equal opportunities to be included in the learning process.
- ▶ Recognize that your classroom may include students whose parents/family/close relatives/family friends work in the fossil fuels industry. It's vital to create a safe and inclusive space where they can freely learn, ask questions, and share their perspectives on renewable energies, fostering a richer and more holistic dialogue for all.

Lesson scenario:**Offshore renewable energies – wind energy****Lesson objectives:**

- ▶ Familiarise students with the definition and potential of offshore wind energy.
- ▶ Introduce offshore wind energy as a renewable energy source, along with its advantages and technologies.
- ▶ Understand the key determinants of offshore wind energy development.

**Working methods:**

- ▶ Lecture
- ▶ Discussion
- ▶ Presentation
- ▶ Brainstorming

**Work format:**

- ▶ Individual
- ▶ Group work

**Teaching tools:**

- ▶ Multimedia projector
- ▶ Multimedia presentation
- ▶ Film
- ▶ Computer with Internet access
- ▶ Blackboard

Course of the lesson:**I. Introduction (10 minutes)**

- 1 Welcoming students and introducing the topic of the lesson.
- 2 The teacher discusses wind farms with the students. They are asked if they have seen such installations and where.
- 3 The teacher presents the table of content of the lesson to the students.

II. Lecture with multimedia presentation (30 minutes)

- 1 Clarification of the definition of the offshore wind energy.
- 2 Shows the map presenting wind speed potential across Earth.
- 3 The teacher explains to the students what offshore wind energy is.
- 4 Then the teacher shows the students how offshore wind turbines generate electricity presenting them the film to them.
- 5 Assignment No.1 - Students are given a diagram of an offshore wind turbine to complete. Once everyone has filled it in, the teacher shows the correct names of all the components on the Slide.
- 6 Assignment No.2 - Students are to think about how big offshore wind turbines are and mark the height of the turbine on the drawing.

- 7 The teacher discusses what offshore wind farms are and why individual turbines are not installed.
- 8 Presentation and discussion of the technology.
- 9 The teacher demonstrates how much energy a single turbine can generate. For older classes: The teacher asks the pupils to choose one device, check how much electricity it uses and see how many of the chosen devices can be powered by one 12 MW offshore wind turbine.
- 10 The teacher discusses the benefits of using offshore wind energy. He/she asks the students on their opinion.
- 11 The teacher discusses the main determinants of the development of this technology.

III. Summary and conclusion (5 minutes)

- 1 A summary – a few take aways on the offshore wind energy.
- 2 Encourage students to explore the topic and seek other information on the subject.
- 3 Thanking students for participating in the lesson.

Comments on the Slides

Slide 4 - What is offshore wind energy

- ▶ Offshore wind energy is a source of clean and renewable energy obtained by harnessing the power of the wind at sea, where it reaches a higher and more constant speed.
- ▶ The wind blows, moving the turbine blades, causing them to move and produce energy.
- ▶ Offshore wind energy is a renewable and infinite source of energy, and converting wind into electricity does not emit harmful greenhouse gases. As we work to combat climate change and reduce greenhouse gases, offshore wind energy will play an important role in our future electricity production.
- ▶ Offshore wind farms generate electricity from wind blowing across the sea. They are considered more efficient than onshore wind farms, due to higher wind speeds, greater stability and the absence of physical interference that can be caused by land or man-made objects.

Slide 5 - Where the offshore wind blows?

- ▶ Operating a wind power plant is more complex than simply erecting wind turbines in a windy area. Wind power plant owners must carefully plan where to position wind turbines and must consider how fast and how often the wind blows at the site.
- ▶ Wind farms tend to be located in the windiest places possible, to maximise the energy they can create.

Slide 6 - How do offshore wind turbines generate electricity?

- ▶ The wind blows, moving the turbine blades, causing them to move and produce energy. To capture wind energy, the top part of the turbine is turned to face the wind, the three blades are set at exactly the right angle, and the movement of the air past them causes them to rotate.
- ▶ The energy is then transferred via seabed cables to the onshore grid.

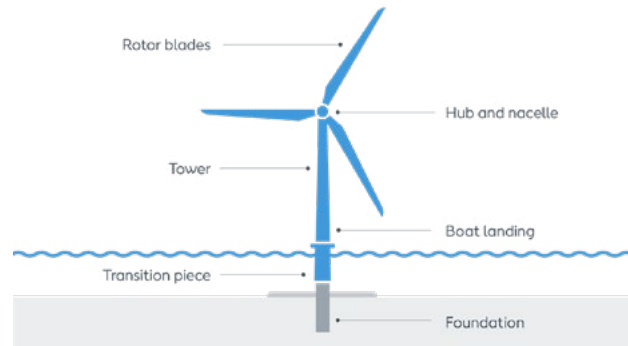
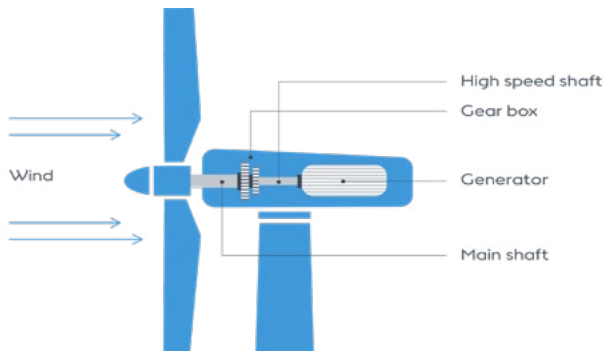
Film on Slide:

<https://www.youtube.com/watch?v=xV4taxLLNlw>

Slide 7/8 - Construction of an offshore wind turbine. How big it is ?

Turbine Components - modern wind turbines come a variety of sizes, but all types generally consist of several main components:

- Rotor Blades** – The rotor blades of a wind turbine operate under the same principle as aircraft wings. One side of the blade is curved while the other is flat. The wind flows more quickly along the curved edge, creating a difference in pressure on either side of the blade. The blades are “pushed” by the air in order to equalize the pressure difference, causing the blades to turn.
- Nacelle** – The nacelle contains a set of gears and a generator. The turning blades are linked to the generator by a main shaft. The generator then converts the rotational energy from the blades into electrical energy.
- Tower** – The blades and nacelle are mounted on top of a tower. Towers are usually between 50-100 m above the surface of the ground or water.
- Foundation** – A foundation is a structure that allows an offshore wind turbine to be fixed to the bottom. There are different types of foundations, according to the depth at which the wind turbine will be installed. The support structure can either be fixed to the ocean floor or utilize floating turbine technology that moors the floating foundation in place. The structures are manufactured from steel or concrete.



Slide 9 - Wind farms.

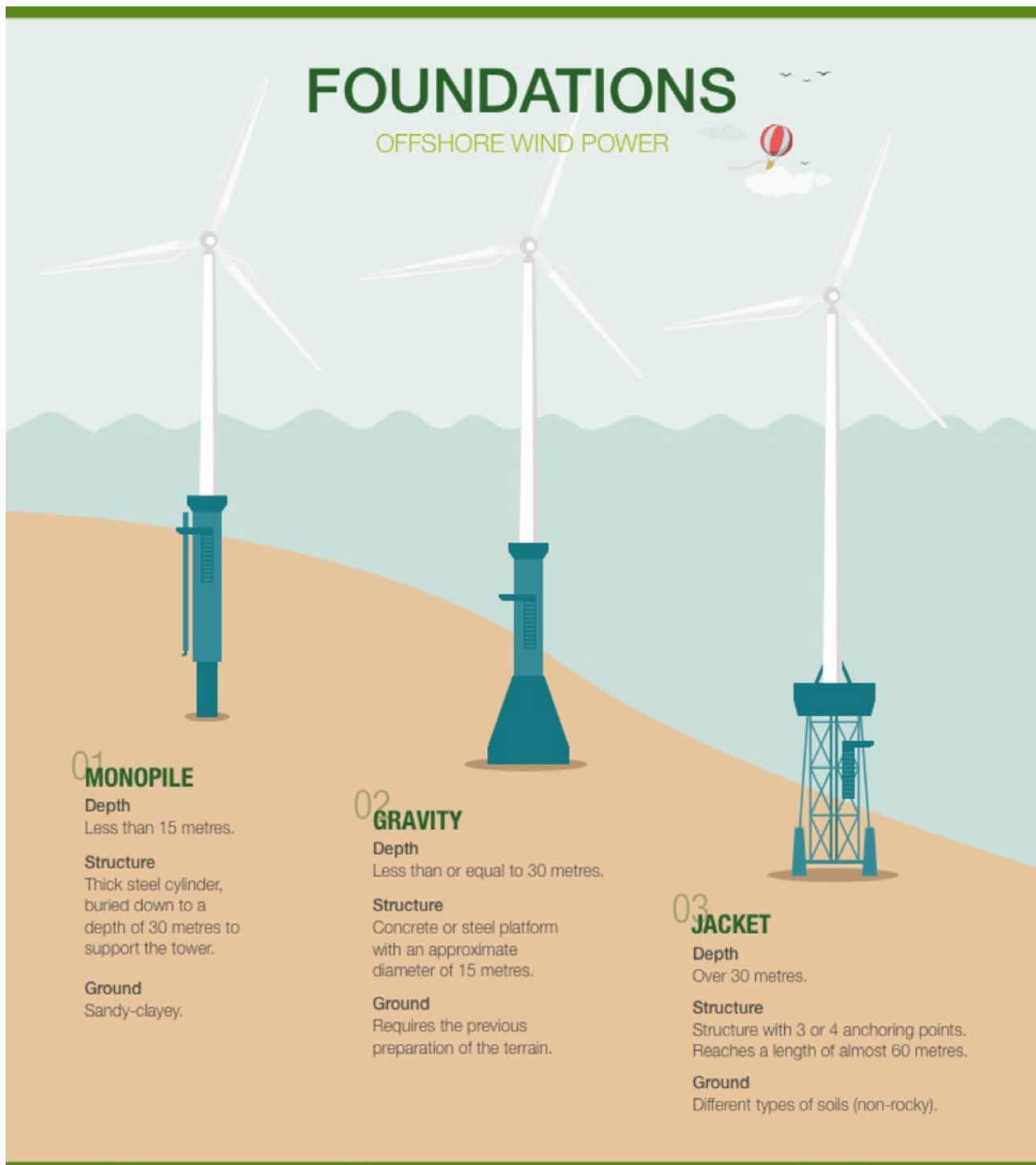
- ▶ A single wind turbine can generate a small amount of energy. That's a lot compared to the power needed to light a home, for example, but not as much as city needs.
- ▶ That's why wind turbines are grouped together to form a wind farm.
- ▶ An offshore wind farm consists of a number of turbines spread over a wide area of the ocean. Each is solidly fixed to the seabed. The electricity flows from the offshore farm to land via cables placed on the seabed.

Slide 10 - Foundations.

In offshore wind farms, wind turbines are elevated over the sea level with different types of foundations, depending on the depth and bottom conditions.

Bottom fixed foundations:

- ▶ There are different types of foundations, according to the depth at which the wind turbine will be installed. Therefore, for example, for shallow waters: monopiles are used; these are quite simple structures, made up of a thick steel cylinder that is anchored directly to the sea bed.
- ▶ More complex support and anchoring structures are required for greater depths to keep turbines in a fix and stable position.

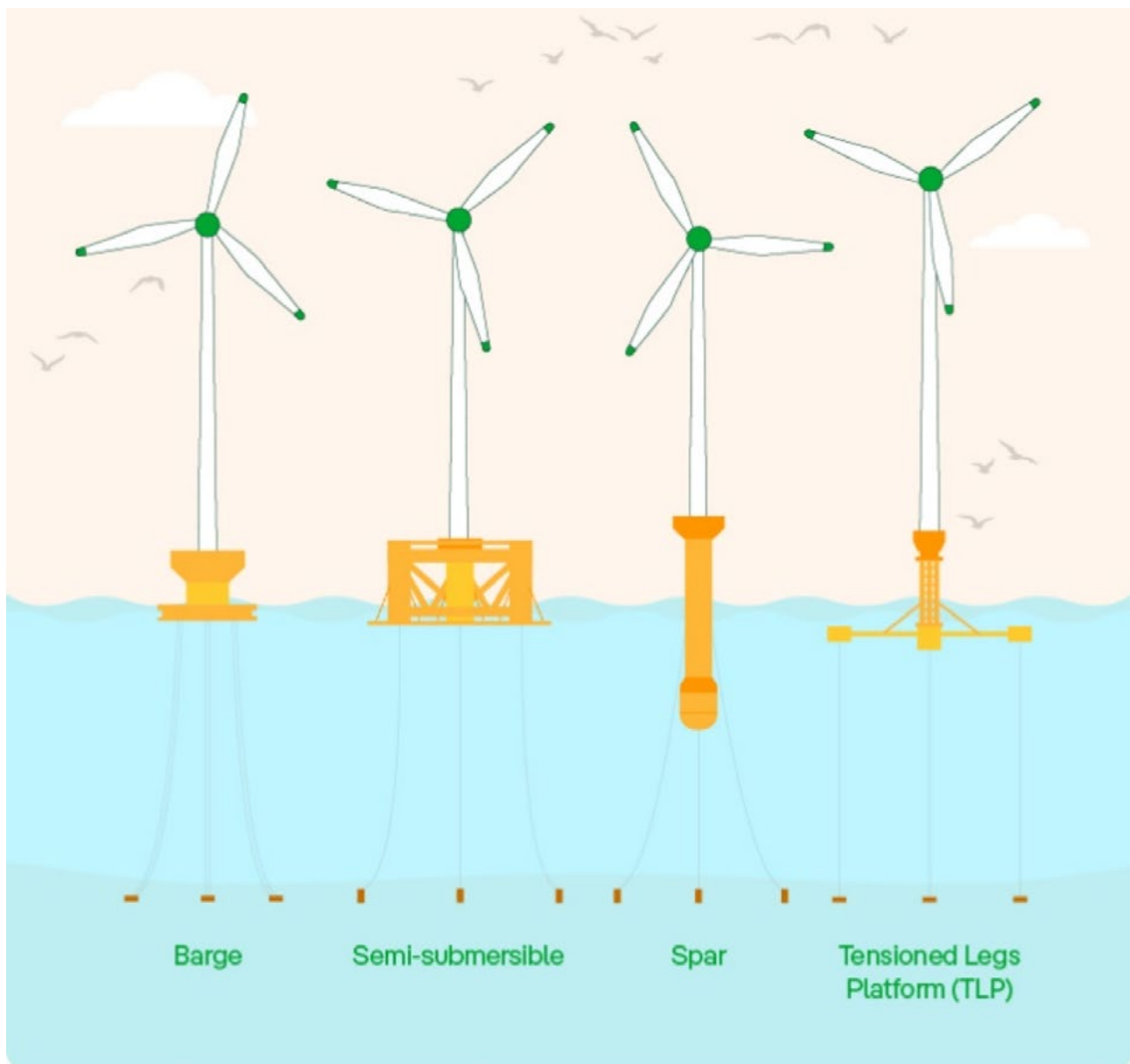


Floating foundations

Floating offshore wind energy is based on floating platforms for wind turbines. The choice of one type or another will depend on sea and seabed conditions, the winds in the area, the size of the wind turbine, the depth of the harbours, the manufacturing facilities or the availability and price of materials and equipment.

- a. **Barge** – The floating platform has a large surface area in contact with the water, which is precisely what gives it stability. Like anchored boats, their movements are limited.
- b. **Semi-submersible** – It is developed form of Barge type with increased stability caused by submerged construction. The greater part, located under the surface, is responsible for greater buoyancy.

- c. **Spar** – Stability here is provided by a floating platform with the greatest load at the lowest point. It has cylindrical shape, installed vertically. As turbines become larger and larger, it requires very long cylinders to compensate for the weights, which makes this solution very difficult to manufacture, transport and install.
- d. **Tensioned Legs Platform (TLP)** – The newest and currently most technically risky concept. The platform is star-shaped and is fixed by the tensioned steel cables – this limits the floating properties for the whole installation but allows for a decrease in platform size and cost of material. In case of loose or damaged ropes, stability would be disturbed.



Slide 11 - What about the floating?

- ▶ Europe continues to lead the way in floating wind installation. Outside Europe and Asia-Pacific, North America has some floating offshore wind installations in operation.
- ▶ Floating offshore wind installations offer new opportunities and alternatives.
- ▶ It opens the door to sites further offshore by allowing the deployment of wind turbines in larger and deeper offshore areas with higher wind potential.
- ▶ Among the advantages of floating offshore wind are the potentially low environmental impact and the ease of manufacture and installation, as the floating turbines and platforms can be built and assembled on land and then towed to the offshore installation site.
- ▶ Today, floating technologies are more expensive than bottom-attached ones, due to the low use of this technology to date and ongoing work to improve it.
- ▶ To date, few suppliers have developed their own floating technology.

Slide 12 - How much energy can we get?

- ▶ One offshore wind turbine (with a capacity of 12 megawatts) can produce enough energy for the annual needs of 16,000 homes. An offshore wind farm consisting of 50 such turbines could provide power for 800,000 households.
- ▶ Hornsea 2, located about 55 miles off the coast of Yorkshire in the North Sea, is the world's largest operating offshore wind farm as of August, 2023. Hornsea 2 can power more than 1.4 million homes.
- ▶ Hywind Tampen is special—it floats. This Norwegian wind farm is the largest floating offshore wind farm in the world with 93 MW of capacity. This is a rather abstract measure for many people, but it means that in the course of a year, the wind farm can provide enough electricity to power 20 000 households.

Slide 13/14 - Where are the installations – World and Europe.

- ▶ The largest number of offshore wind farms is in China.
- ▶ Worldwide, 257 offshore wind farms are currently in operation of which 140 are located in Asia, 115 in Europe and 2 in the USA.
- ▶ In Europe, by August 2023, the country with the largest number of offshore wind farms was the UK, followed by Germany, the Netherlands, Denmark and Belgium.

Slide 15 - Why do we need offshore wind energy?

- ▶ Distance from local populations, therefore cancelling worries about noise from the rotation of the wind turbine blades and reducing the impact on local environments.
- ▶ Economies of scale - due to the possibility of using larger turbines and more powerful and constant winds, more electricity production in a smaller area,
- ▶ Job creation – Over the past ten years, the offshore wind industry has grown significantly and created thousands of new jobs - up to 75 000 in Europe alone.
- ▶ Concerns about impacts on birds and marine life - Wind farm developers work closely with local environmental groups as part of the consultation process on the location and scale of wind farms so as to reduce impacts on living organisms during the construction and operation of offshore farms.
- ▶ Clean energy - Offshore wind power is a constantly renewable and infinite energy source, and the conversion of wind into power creates no harmful greenhouse gas emissions. Not only is wind an abundant and inexhaustible resource, but it also provides electricity without burning any fuel or polluting the air.
- ▶ Energy security - no need to use any energy raw materials to produce electricity, no need to import raw materials. Uses locally available wind resources.
- ▶ Economic development - Wind energy projects provide many economic benefits, including new jobs, land lease payments, local tax revenue, and lower electricity prices.

- ▶ Lower electricity bills – on top of being clean and green, offshore wind power is cost-efficient so electricity bills should be lower.

Slide 16 - What are the main challenges?

Technology:

- ▶ Floating wind farms - floating offshore wind turbines are an exciting technology development. These will allow wind farms to be tethered to the seabed and positioned further out to sea in deeper waters where winds are stronger, thus boosting offshore wind power capacity even further.
- ▶ Bigger/Taller wind turbines - technology is constantly evolving, both in terms of increasing the size of facilities and reducing the environmental impact (e.g. recyclable turbines).

Infrastructure:

- ▶ A very big challenge is the construction of the infrastructure needed to connect offshore wind farms onshore to the electricity grid and the ports that will enable the construction of offshore farms.

Recycling:

- ▶ For wind turbines to be considered totally sustainable they must be built from 100% recyclable products. That's why engineers across the world are now focusing efforts on designs that use materials such as thermoplastics that are biodegradable, or that can be reconstituted at the end of their lives.

Other users of the sea:

- ▶ Offshore wind installations are typically seen as a winning solution to growing the renewable energy markets by harnessing a natural resource that would otherwise go untapped. However, as plans for offshore wind farms become larger and more numerous, questions are being raised as to how existing users of the marine environment will be able to coexist with these 'space and resource-intensive installations.
- ▶ Developers are working on the coexistence between offshore wind and other users of the sea space such as fisheries, the military or civil shipping.

Skills and education:

- ▶ One of the fundamental problems for the offshore wind sector is the lack of sufficient skilled workers to meet the ambitious targets for the development of this technology.
- ▶ The sector needs a range of qualified technicians with relevant certifications, but also logisticians, lawyers, project managers, economists, purchasing specialists, etc.
- ▶ Today, it is extremely important to ensure that as many people as possible are properly qualified and to raise public awareness of the sector and bring employment opportunities closer to them.

Permitting:

- ▶ The process of building offshore wind farms is very long. Efforts must be made to shorten the administrative procedures and enable these investments to be built more quickly.

Sources:

- ▶ National grid - energy explained
<https://www.nationalgrid.com/stories/energy-explained/what-offshore-wind-power>
- ▶ Orsted: How do offshore wind turbines work?
<https://us.orsted.com/renewable-energy-solutions/offshore-wind/what-is-offshore-wind-power/how-do-offshore-wind-turbines-work>
- ▶ Iberdrola: Floating offshore wind power: a milestone to boost renewables through innovation
<https://www.iberdrola.com/innovation/floating-offshore-wind>
- ▶ Energy kids: Wind basics
<https://www.eia.gov/kids/energy-sources/wind/>
- ▶ Energy education: wind turbina
https://energyeducation.ca/encyclopedia/Wind_turbine
- ▶ Offshore Wind Maryland: How Electricity is Generated
<https://offshorewindmaryland.org/how-offshore-wind-works/how-electricity-is-generated/>
- ▶ What Does Offshore Wind Energy Look Like Today? | Department of Energy
<https://www.energy.gov/eere/wind/articles/what-does-offshore-wind-energy-look-today>
- ▶ The World's Largest Offshore Wind Farm - Dogger Bank Wind Farm
<https://doggerbank.com/>
- ▶ New York's first wind farm will power 70,000 homes - Ramboll group
<https://www.ramboll.com/projects/energy/new-york-s-first-wind-farm-will-power-70-000-homes>
- ▶ Speech by the Prime Minister at the opening of Hywind Tampen - regjeringen.no
<https://www.regjeringen.no/en/aktuelt/speech-by-prime-minister-at-the-opening-of-hywind-tampen/id2991964/>
- ▶ Hornsea One - Offshore Wind Farm | Ørsted (orsted.co.uk)
<https://orsted.co.uk/energy-solutions/offshore-wind/our-wind-farms/hornsea1>
- ▶ WFO_Global-Offshore-Wind-Report-2022.pdf (wfo-global.org)
https://wfo-global.org/wp-content/uploads/2023/03/WFO_Global-Offshore-Wind-Report-2022.pdf
- ▶ Global Offshore Wind Report 2023 - Global Wind Energy Council (gwec.net)
<https://gwec.net/gwecs-global-offshore-wind-report-2023/>
- ▶ Offshore wind in Europe - key trends and statistics 2022 | WindEurope
<https://windeurope.org/intelligence-platform/product/offshore-wind-in-europe-key-trends-and-statistics-2022/#findings>
- ▶ Circular Economy in Offshore Wind - ORE (catapult.org.uk)
<https://ore.catapult.org.uk/what-we-do/innovation/circular/>
- ▶ Revised EU Renewables Directive set to speed up wind permitting | WindEurope
<https://windeurope.org/newsroom/news/revised-eu-renewables-directive-set-to-speed-up-wind-permitting/>

QUIZ: Offshore wind energy

Guidelines: Adapt the quiz to your needs. You can use available apps, such as Kahoot, to create an online version or print and hand out to pupils.

Task 1: Mark whether the given sentence is true or false

1. **Offshore wind energy is one of the offshore renewables.**
☐ TRUE ☐ FALSE Answer: True.
2. **A nacelle is the moving part of an offshore wind turbine that is “pushed” by the wind.**
☐ TRUE ☐ FALSE Answer: False.
3. **Wind farms tend to be located in the windiest places possible, to maximise the energy they can create.**
☐ TRUE ☐ FALSE Answer: True.
4. **An offshore wind farm is made up of many turbines spread out over a wide area of ocean.**
☐ TRUE ☐ FALSE Answer: True.
5. **In the shallowest waters, floating foundations are used.**
☐ TRUE ☐ FALSE Answer: False.
6. **Floating foundations are one of the most common technologies for fixing offshore wind farms to the seabed.**
☐ TRUE ☐ FALSE Answer: False.

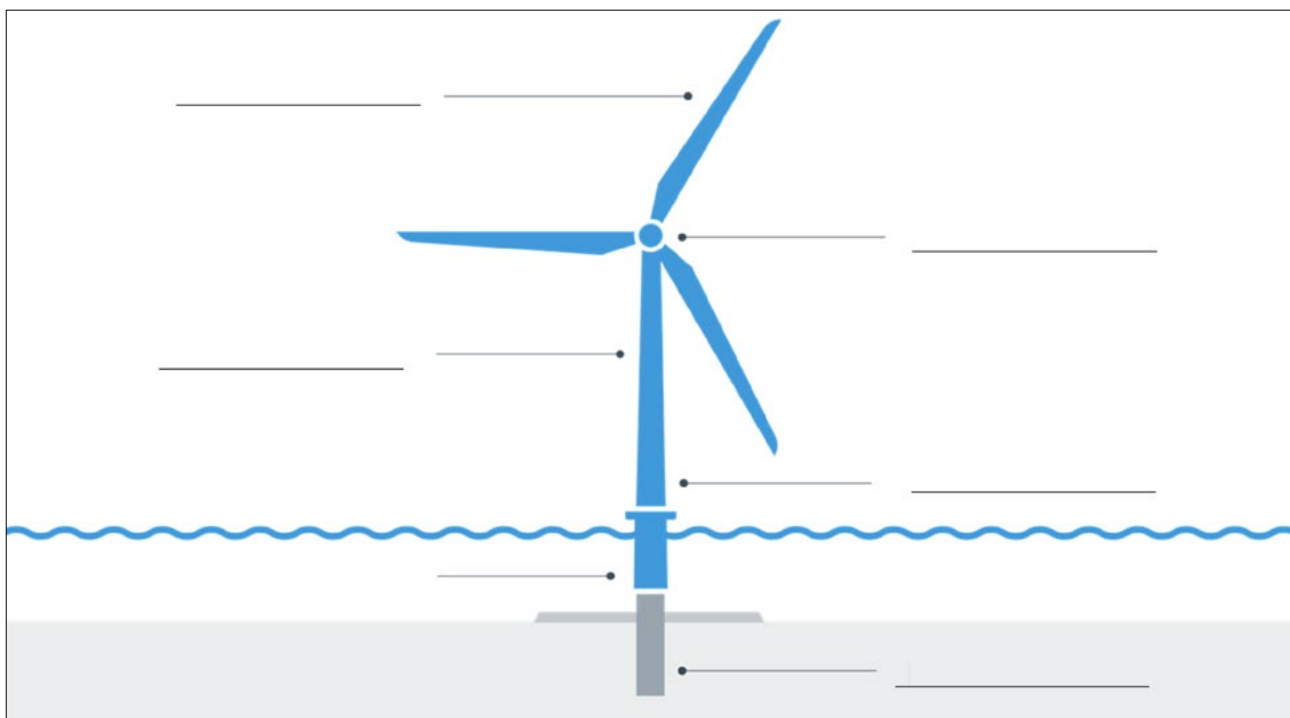
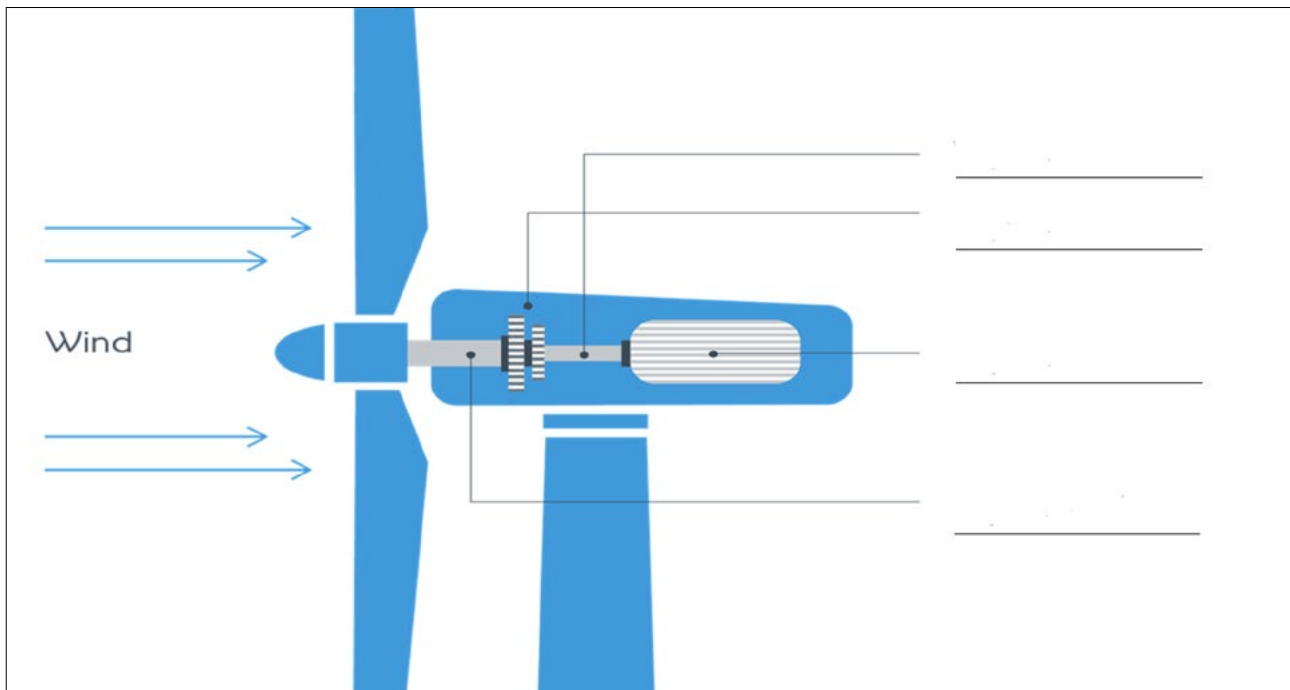
Task 2: Single-choice test. Mark the correct answer

1. **One of the floating foundation technologies for offshore wind farms is?**
☐ a. Monopile
☐ b. Barge
☐ c. Jacket Correct answer: b
2. **One of the bottom-fixed foundation technologies for offshore wind farms is?**
☐ a. Monopile
☐ b. Barge
☐ c. Tension Leg Platform Correct answer: a
3. **Which country has the most offshore wind farms in the world?**
☐ a. UK
☐ b. Taiwan
☐ c. China Correct answer: c
4. **Which country has the most offshore wind farms in Europe?**
☐ a. UK
☐ b. Germany
☐ c. Denmark Correct answer: a

Assignment No. 1

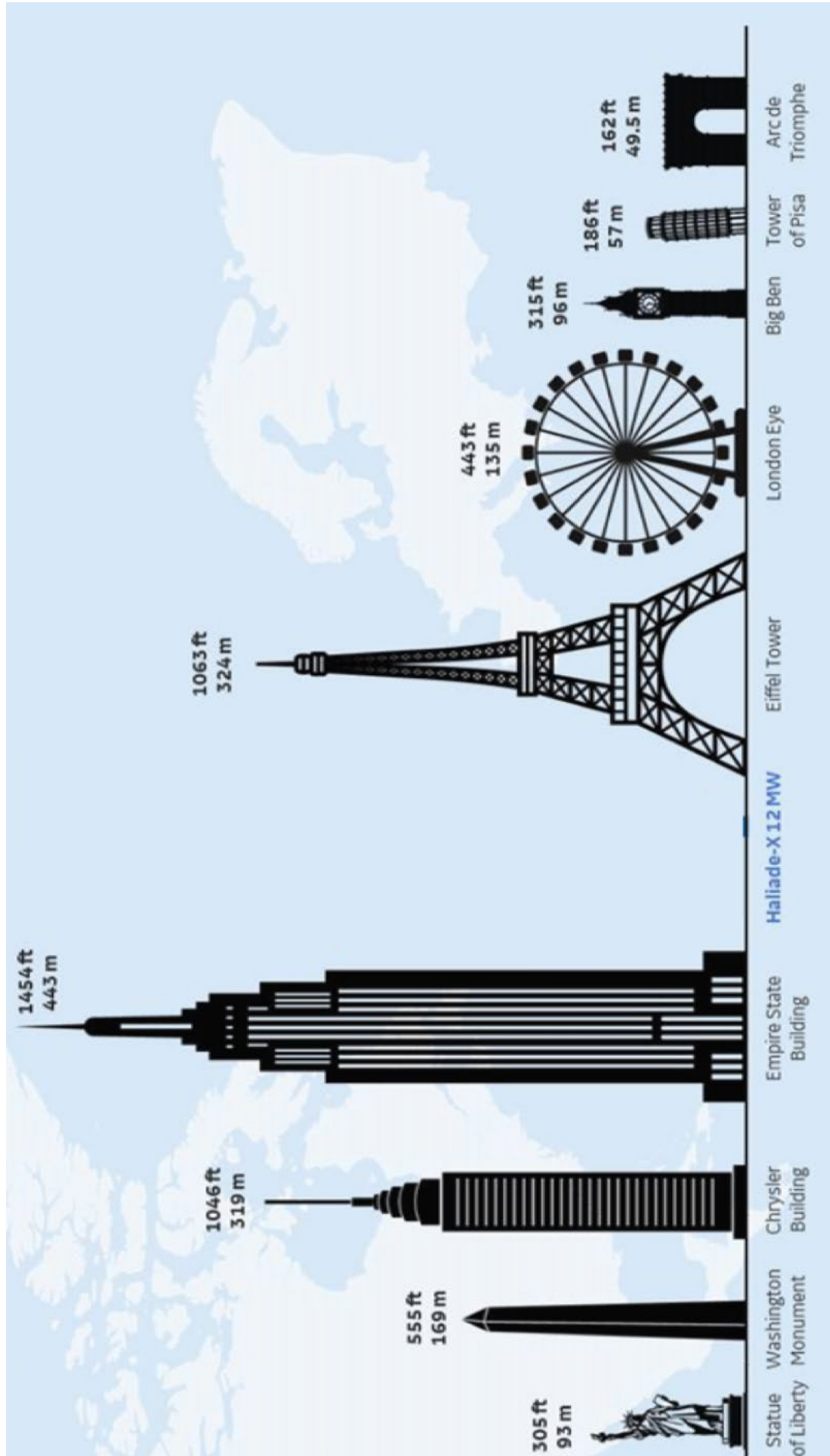
Name the different components of an offshore wind turbine using the words below:

High speed shaft / Gear box / Generator / Main shaft / Rotor blades / Tower / Hub and nacelle / Boat landing / Transition piece / Foundation



Assignment No. 2

Consider how high offshore wind turbines are and mark its height on the drawing. Try to draw the turbine



Additional sources



Organizations

- ▶ WindEurope
- ▶ Global Wind Energy Association
- ▶ National Wind Energy Associations, e.g. Polish Wind Energy Association, RenewableUK, Asociación Empresarial Eólica etc.

Useful webpages

- ▶ [What is Wind Energy? - Earth.Org Kids](#)
- ▶ [Wind: Energy Source Fact File! - Fun Kids - the UK's children's radio station \(funkidslive.com\)](#)
- ▶ [Wind - Energy Kids: U.S. Energy Information Administration \(EIA\)](#)
- ▶ [Wind facts for kids \(windenergyireland.com\)](#)
- ▶ [Environment for Kids: Wind Power \(ducksters.com\)](#)
- ▶ [BWEA_School_Pack.pdf \(earth.org.uk\)](#)
- ▶ [Education | Blue Gem Wind](#)
- ▶ [www.ge.com](#)
- ▶ [www.vestas.com](#)
- ▶ [www.siemensgamesa.com](#)
- ▶ [www.gwec.com](#)
- ▶ [www.windeurope.org](#)

YouTube films

- ▶ [Is offshore wind the energy of the future? - YouTube](#)
- ▶ [The largest offshore wind farm in the world | 60 Minutes - YouTube](#)
- ▶ [Floating Offshore Wind Turbine Installation - Kincardine project Scotland - YouTube](#)
- ▶ [Floating Offshore Wind Turbine Installation with Stiesdal Foundation - YouTube](#)
- ▶ [Floating wind turbine installation - YouTube](#)
- ▶ [Watch the World's First Floating Wind Farm Ride the Waves | National Geographic - YouTube](#)
- ▶ [Installing floating wind - Episode 4: Hook-up operation - Youtube](#)
- ▶ [Foundation Installation of Offshore Wind Farms - SUT+ Webinar - YouTube](#)
- ▶ [Foundations for offshore wind turbines - YouTube](#)
- ▶ [Monopile Installations with our new Wind Installation Vessel design - YouTube](#)
- ▶ [Offshore Wind Noise Reduction Workshop - Session 1: Foundations & Installation Methods - YouTube](#)
- ▶ [Why Finding A Spot For Offshore Wind Is So Tricky - Cheddar Explains - YouTube](#)
- ▶ [There are 'problems' needing to be addressed with offshore wind farms - YouTube](#)

Reports

- ▶ [Global Offshore Wind Report 2023 - Global Wind Energy Council \(gwec.net\)](#)
- ▶ [Reports | WindEurope](#)
- ▶ [Offshore Wind Market Report: 2023 Edition \(energy.gov\)](#)
- ▶ [Future of Wind – A Global Energy Transformation paper \(irena.org\)](#)

Initiatives for kids

- ▶ [Home | OffshoreWind4Kids](#)
- ▶ [Wind4Kids | Inspire Kids About Wind Energy](#)
- ▶ [Wind Energy for Kids! A new space to bring wind energy closer to children \(siemensgamesa.com\)](#)
- ▶ [KidWind Offshore Wind Academy \(kidwindacademy.com\)](#)

Additional resources for educators

What offshore wind is:

- ▶ [Seven facts about offshore wind | Ørsted \(orsted.com\)](#)
- ▶ [offshore-for-children-how-to-catch-the-wind.pdf \(usercontent.one\)](#)
- ▶ [What is Wind Energy | Science for Kids - YouTube](#)
- ▶ [What is offshore wind power? | National Grid Group](#)

Where the wind blows:

- ▶ [Global Wind Atlas](#)
- ▶ [Global Offshore Wind Technical Potential | Data Catalog \(worldbank.org\)](#)
- ▶ [Offshore Wind Technical Potential | Analysis and Maps | ESMAP](#)
- ▶ [Where Does Wind Come From? | The Science of Flying | SciShow Kids - YouTube](#)

How offshore wind generates electricity:

- ▶ [How does a wind turbine work? | National Grid Group](#)
- ▶ [How a Wind Turbine Works - Text Version | Department of Energy](#)
- ▶ [How does a wind turbine work? | Sustainability - ACCIONA - YouTube](#)
- ▶ [How is wind energy produced? - Sustainability for kids Part 1 | Vestas - YouTube](#)
- ▶ [How does a wind turbine work? - Sustainability for kids Part 2 | Vestas - YouTube](#)
- ▶ [How Offshore Wind Farms Work - YouTube](#)

Offshore wind turbines construction:

- ▶ [Offshore Wind Turbines | Vestas](#)
- ▶ [Offshore Wind Turbines | Siemens Gamesa](#)
- ▶ [Wind Turbine Components - Windmills Tech](#)
- ▶ [What are the five principal wind turbine parts? | Crosby Airpes](#)
- ▶ [How do offshore wind turbines work? - YouTube](#)

Foundations:

- ▶ <https://blog.virtuosity.com/all-about-offshore-wind-turbine-foundations>
- ▶ <https://www.iberdrola.com/sustainability/offshore-wind-turbines-foundations>
- ▶ [What is offshore wind and what does its future look like? | World Economic Forum \(weforum.org\)](#)
- ▶ [The Foundation of Wind Turbines - IN 60 SECONDS - YouTube](#)

Floating wind:

- ▶ [Floating offshore wind, what is it and how does it work? - Iberdrola](#)
- ▶ [Guide to a floating offshore wind farm | An informative resource for floating offshore wind \(guidetofloatingoffshorewind.com\)](#)
- ▶ [Floating offshore wind power - YouTube](#)
- ▶ [The Fascinating Process of Installing Billions \\$ Wind Farms in Middle of the Ocean - YouTube](#)
- ▶ [Floating wind turbines: Offshore energy's secret weapon - YouTube](#)
- ▶ [Overview of Floating Offshore Wind - YouTube](#)

Power generation:

- ▶ [Haliade X: largest wind turbine ever | TNO](#)
- ▶ [How Many Homes Can Be Powered by a Wind Turbine? \(todayshomeowner.com\)](#)
- ▶ [Offshore wind turbines power more than 2 million U.K. homes daily | 60 Minutes - YouTube](#)

Installations:

- ▶ [WFO_Global-Offshore-Wind-Report-2022.pdf \(wfo-global.org\)](#)
- ▶ [Global Offshore Wind Report 2023 - Global Wind Energy Council \(gwec.net\)](#)
- ▶ [Offshore wind in Europe - key trends and statistics 2022 | WindEurope](#)

Advantages and disadvantages:

- ▶ [What are the advantages and disadvantages of offshore wind farms? | American Geosciences Institute](#)
- ▶ [Offshore wind farms construction - advantages and disadvantages - Eltel Networks](#)
- ▶ [What is offshore wind power? | National Grid Group](#)
- ▶ [Advantages of offshore wind | Ørsted \(orsted.com\)](#)
- ▶ [What Are the Health and Climate Benefits of Offshore Wind Farms? – C-CHANGE | Harvard T.H. Chan School of Public Health](#)

Challenges:

- ▶ [Circular Economy in Offshore Wind - ORE \(catapult.org.uk\)](#)
- ▶ [Revised EU Renewables Directive set to speed up wind permitting | WindEurope](#)
- ▶ [Enabling frameworks for offshore wind scale up: Innovations in permitting \(irena.org\)](#)
- ▶ [Key challenges facing offshore wind farm development \(spinergie.com\)](#)
- ▶ [What are the advantages and disadvantages of offshore wind farms? | American Geosciences Institute](#)
- ▶ [Onshore vs offshore wind energy: what's the difference? | National Grid Group](#)
- ▶ [What is offshore wind power? | National Grid Group](#)
- ▶ [Offshore wind energy: Challenges and opportunities emerging from new European expansion targets - YouTube](#)
- ▶ [Is offshore wind the solution to the EU's energy challenges | POLITICO Events - YouTube](#)



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