SDG14 Future of the Ocean
MM3: Offshore Renewable Energy

Micro-Module 3: Offshore Renewable Energy

Research and Development

Lesson 7: Building Strong Foundations 2

Subjects: Climate Action and Sustainable Development, Design, English, Engineering Science

Lesson Title and Summary: Building Strong Foundations 2

Building on the last lesson, the focus shifts to wind turbine foundations through a brief video, followed by brainstorming. A detailed video on foundation design delves into essential information for proper design, encouraging visual analysis. The lesson concludes with a brief brainstorm and 2D prototype of a strong offshore wind turbine which will be built on in the next lesson. This dynamic approach empowers learners to grasp foundation principles and apply them to real-world scenarios.

Vocabulary: Foundation, Structure, Monopile, Floating Foundation, Bearing Capacity of Soil, Load Path, Super-structure, Sub-structure

In this lesson, the learner will:

- Explore the unique challenges and solutions associated with wind turbine foundations, particularly in offshore environments.
- Delve into the intricacies of foundation design, focusing on key visual elements for effective understanding.

Materials

- Worksheet: Foundation Design
- Pen and paper
- Internet Access

MM3: Offshore Renewable Energy
L7 Building Strong Foundations 2

ACTIVITY INSTRUCTIONS

Activity 1: Wind turbine foundations (15 mins)

1. Play the video The Foundation of Wind Turbines - IN 60 SECONDS [1:22 mins] by DOB-Academy.
2. Have learners answer the questions on Worksheet: Foundation Design Part 1.
3. Share as a class.

Activity 2: Foundation design (20 mins)

1. Play the video Fugro Offshore Wind Farm Foundation Design [1:50 mins].
2. Ask learners to complete the worksheet: Foundation Design Part 2.
3. Share as a class.
4. After playing the video once through, pause the video at 0:23 sec, 0:30 sec, 0:52 sec, 1:19 min, 1:26 min and 1:28 min. At each pause point, have learners discuss the image using the questions on the worksheet: Foundation Design Part 3.
5. Discuss as a class.

Activity 3: Brainstorming (15 mins)

1. Tell learners that they will build a wind turbine next class.
2. Divide learners into groups of 2.
3. Have learners brainstorm how they would design their wind turbine based on the information they have learned in the module so far.
4. Learners may wish to draw or sketch their design and bring this to the next class.
5. Share as a class.

REFLECTIVE EXERCISE: 3-2-1

- Three things they feel they have learnt from the exercise
- Two things they found most interesting and would like to explore more
- One – their opinion they have about the site / exercises

Use Post-its or a Mentimeter survey - mentimeter.com to gather reflections

MM3: Offshore Renewable Energy
L7 Building Strong Foundations 2

EXTENSION / REDUCTION ACTIVITIES:

Reduction: For a shorter class, skip activity 3.

Extension: For a longer class, consider playing the videos a second time, as there is a significant amount of information included in each one, even though they are short videos. Allow learners more time to brainstorm.

Option B: Utilise Codling Wind Park as a case study - see Local Trip / Expertise / Additional Work and Assessments Box, as an extension activity over a number of lessons that could contribute to a walking debate and introduce them to the public consultation process

MEDIA BOX: (materials, online video links, extra resources, case studies etc)

The Foundation of Wind Turbines - IN 60 SECONDS [1:22 mins] https://www.youtube.com/watch?v=NQwuRV2MFs8&ab_channel=DOB-Academy

Fugro Offshore Wind Farm Foundation Design [1:50 mins] https://www.youtube.com/watch?v=38CSrh8l3iI&ab_channel=Fugro

Local Trip / Expertise / Additional Work and Assessments

Is there a construction site nearby? If so, they often have viewing windows. See if you can get a view of what type of foundation they are using – is it a shallow one or a deep one?

For the Arklow bank wind farm in Ireland, can you find out what type of foundations were used in its construction? Were they monopile foundations or floating foundations?

Learners could visit Codling Wind Park online and look at their Phase 1 and Phase 2 consultation documents and consider the process for its ethics and community engagement

MM3: L7 WS FOUNDATION DESIGN

Part 1

After the video, answer the following questions.

What are the types of support structures for wind turbines?

_____

_____

_____

What is the industry favourite?

_____

_____

_____

What are the parts of the monopile?

_____

_____

_____

Why is it popular?

_____

_____

_____

What depths of water is it used in?

_____

_____

_____

What must the do to the monopile if there is a heavier structure or it is placed in deeper water?

_____

_____

_____

what are the limiting factors?

_____

_____

_____

MM3: L7 WS FOUNDATION DESIGN

What is an alternative method for deeper waters?

How is it connected to the seabed?

What is the limiting factor?

What are the benefits?

Part 2

After the video, answer the following questions.

What is Fugro? What do they do?

What challenges are they facing when building new wind turbines? Why are they using site-specific information to build turbines?

What are their selling points (e.g. cost effective)?

Why is having the right kind of foundation important? What do the turbines need to withstand?

Part 3

Your teacher will pause on a number of images from the video. For each image, discuss the following questions with your partner. You may want to take notes of your discussion on a separate piece of paper.

What do you see in the image?

What kind of foundation are they using in each image? Why do you think they chose this type of foundation for the turbines shown in the each image?

Which types of foundation do you like? Which ones do you think are the best?