T-shore Education

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Learning Scenario Manual

Module:
Offshore Renewable Energy
Learning scenario:
Introduction to offshore renewable energy

Co-funded by the European Union

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This document has been created as part of the wider T-shore project, co-funded through the European Union's ERASMUS+ programme.

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Document Information

Project Acronym	**T-shore**
Project Title	Technical Skills for Harmonised Offshore Renewable Energy
Award Number	Project 101055746
Work Package	WP3,4
Deliverable	LSC – Learning scenario manual
Document Title	Offshore Renewable Energy learning scenario manual
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Version Control

Version No.	Date	Description	Prepared by	Checked by
01	17.04.2025	New instruction created	Ivan Coates	All partners
0.2	26.05.2025	Document Update	DH	

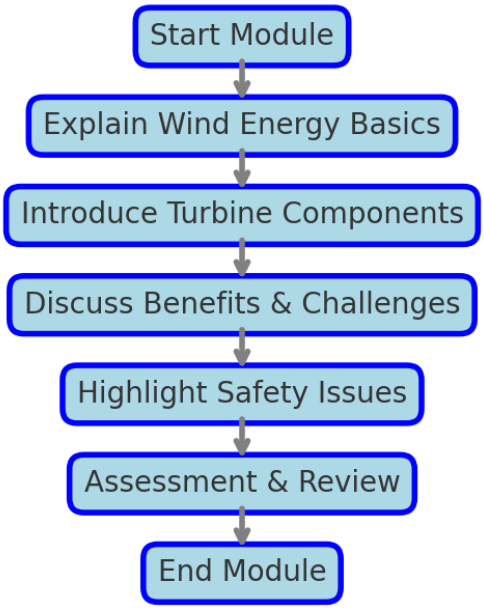
Note This is a fictive generic equipment checklist intended for training purposes and therefore may vary from the equipment checklist provided by a company. It is important that a technician always read and fill checklist carefully prior to any task.

1 Table of Contents

2 Overview

This instructor's manual is designed to accompany the e-learning module "Introduction to Wind Energy." The module is intended to be primarily self-guided by training participants, but the instructor plays an essential role in facilitating understanding, discussion, and reflection at the beginning and end of each chapter.

The manual provides structured guidance to help any instructor, regardless of their prior experience with wind energy, effectively support training participants throughout the course.



3 General Teaching Instructions

Task	Description
Chapter Introduction	Provide a brief overview of the chapter content. Use real-world scenarios or multimedia to spark interest.
Support During Learning	Encourage training participant engagement, clarify doubts, and offer additional resources. Facilitate collaborative discussions if needed.
Reflection and Recap	Guide training participant through a discussion or written reflection summarising what they learned and how it applies to real-life scenarios.

Note: Each chapter includes suggested reflection questions and key points to emphasise during the introduction and recap sessions.

Step	Content	Teaching Strategy
Introduction	Start with a question: 'How did ancient people harness the power of nature?' Introduce early sailboats and Persian windmills.	Visual Aid: Timeline graphic Media: Short video of wind-powered boats and historical windmills
Ancient Times	Discuss wind used for sailing—key to trade and mobility. Focus on Egyptian, Greek, and Phoenician uses.	Class Discussion: How did wind shape early civilisations?
Middle Ages	Windmills used for grinding grain and irrigation. Cover Persian vertical-axis windmills and Dutch tower mills.	Activity: Compare windmill types using images or interactive 3D models
Industrial Era	Wind energy used for mechanical tasks, especially in agriculture. Scenario: wind pumps in rural America.	Practical training demo: Build a simple wind pump model or show a working scenario
20th Century	First electricity-generating turbines (e.g., Denmark, 1890s). WWII era usage. Post-war decline due to fossil fuels.	Scenario Study: Poul la Cour's work. Discussion Prompt: What slowed wind energy adoption in this period?
21st Century	Technological innovation leads to modern wind farms (onshore & offshore). Global push for renewables.	Infographic Analysis: Wind capacity growth charts. Explore role of policy, economics, and innovation in modern wind energy.
Reflection	Encourage reflection: – How has wind's role evolved? – What lessons apply to today? – How do societal needs affect energy innovation?	Group Activity: Build a historical timeline. Role-play: Debate energy sources as historical figures. Journal Prompt: Inventor's sales pitch.

4 Chapter-by-Chapter Guide

4.1 Chapter 1: History - Use of Wind

Objectives: Understand the historical context and evolution of wind use.

Teaching Step	Content
Intro	Discuss the earliest use of wind (sailing ships, windmills). Show historical images.
Reflection	How has the role of wind evolved in human society? What can we learn from history for modern energy use?
Expanded Teaching Steps	

4.2 Chapter 2: What is Wind?

Objectives: Understand the atmospheric and physical principles behind wind.

Teaching Step	Content
Intro	Use animations to show how wind forms due to temperature differences and Earth's rotation.
Reflection	Why is wind considered a renewable resource? What affects wind speed and direction?

4.3 Chapter 3: Converting Wind into Power

Objectives: Learn the basic principles of energy conversion.

Teaching Step	Content
Intro	Use a simple diagram to explain kinetic to mechanical to electrical energy.
Reflection	How efficient is wind energy compared to other sources? What are the limitations?

4.4 Chapter 4: Wind Turbine Classification

Objectives: Understand types of wind turbines.

Teaching Step	Content
Intro	Explain horizontal vs. vertical axis turbines. Use images or a comparison table.
Reflection	Which type of turbine is better suited for urban areas? Why?

4.5 Chapter 5: Wind Turbine Main Components

Objectives: Identify and understand key parts.

Teaching Step	Content
Intro	Show labeled diagrams of turbine components: rotor, nacelle, tower, etc.
Reflection	Which component is most critical to performance? What happens if one part fails? Can the training participant name all components

4.6 Chapter 6: Monitoring Wind Systems

Objectives: Explore tools and systems used for monitoring.

Teaching Step	Content
Intro	Demonstrate how data is collected from turbines (SCADA systems).
Reflection	Why is continuous monitoring important? What could be detected early?

4.7 Chapter 7: Onshore vs. Offshore Wind Farms

Objectives: Compare the two environments.

Teaching Step	Content
Intro	Discuss pros and cons using a table. Show map of wind farms.
Reflection	Which type has more potential in your region? What are the challenges?

4.8 Chapter 8: Operating Principles

Objectives: Understand how wind turbines operate day-to-day.

Teaching Step	Content
Intro	Use a flow diagram of power generation from wind to grid.
Reflection	What makes a turbine start or stop? How does the control system work?

4.9 Chapter 9: Generation of Power

Objectives: Dive deeper into electricity generation.

Teaching Step	Content
Intro	Explain generator types (synchronous/asynchronous). Use simplified electrical diagrams.
Reflection	How does power output vary with wind speed? What ensures grid compatibility?

4.10 Chapter 10: Maintenance and Repair

Objectives: Learn about upkeep and common repairs.

Teaching Step	Content
Intro	Discuss scheduled maintenance and types of failures. Show images of technicians at work.
Reflection	How does maintenance affect cost-effectiveness? What are the safety considerations?

4.11 Chapter 11: Troubleshooting

Objectives: Learn to identify and solve common problems.

Teaching Step	Content
Intro	Provide scenarios with faults and ask how training participants would respond.
Reflection	How can early detection prevent bigger issues? What tools assist troubleshooting?

4.12 Chapter 12: Safety and Other Issues

Objectives: Understand safety protocols and environmental challenges.

Teaching Step	Content
Intro	Introduce PPE, site access rules, and weather considerations. Use video clips of safety drills.
Reflection	Why is safety culture essential? What risks are unique to wind farms?

5 Safety Issues for Wind Technicians

- Wind technicians work in challenging environments and must adhere to strict safety protocols. Key safety issues include:
  - Working at heights: Technicians often work hundreds of feet above ground, requiring fall protection systems.
  - Peer Rescue Systems and Standards

- Electrical hazards: Wind turbines generate high voltages; proper lockout/tagout procedures are essential.
- Mechanical hazards: Moving parts such as blades and gearboxes can pose significant risks + Moving parts such as the hydraulic systems in a wind turbine and the hydraulic tools used to apply mechanical stresses.
- Weather conditions: Lightning, high winds, and ice can make turbines dangerous to access.
- Confined spaces: Some components require technicians to work in tight, enclosed areas.
- Emergency procedures: Training in rescue techniques and first aid is critical for responding to accidents.

5.1 Chapter 13: Positive and Negative Impacts

Objectives: Evaluate the broader impact of wind energy.

Teaching Step	Content
Intro	Discuss environmental, economic, and societal impacts using a pros and cons chart.
Reflection	Is wind energy truly sustainable? What trade-offs are acceptable?

Milestones	Content Summary	Activities & Tools
1. What is Wind Energy?	Introduction to wind as a renewable resource.	Interactive animation, quiz
2. How Wind Turbines Work	Parts of a turbine and energy conversion process.	Drag-and-drop diagram, 3D models
3. Wind Farms	Onshore and offshore wind farms.	Map exploration, scenario study
4. Pros and Cons of Wind Energy	Evaluation of impacts.	Debate, reflection activity
5. The Future of Wind Energy	Innovations and global trends.	Research project, discussion forum

5.2 Suggested Tools and Resources

- Videos and animations from open education platforms (e.g., YouTube, TED-Ed)
- Printable diagrams for labeling exercises
- Access to online scenario tools for wind energy
- Sample data sets from actual wind farms for analysis activities

5.3 Final Tips for Instructors

- Encourage training participants to maintain a learning journal.
- Invite guest speakers from local wind energy companies if possible.
- Adapt pace and depth based on training participant familiarity and interest.

This manual ensures a consistent and rich learning experience across classrooms and instructors. Wind energy education is not only about understanding technology but about preparing for a cleaner, more sustainable future.

Co-funded by the European Union

The T-shore project is funded through the the Erasmus+ Centres of Vocational Excellence (CoVEs) call 2021

Acknowledgements

We would like to extend our sincere thanks to all the project partners for their invaluable contributions to this report and their dedicated work on the T-shore project.
Our deepest appreciation also goes to all T-shore stakeholders, particularly the members of the regional Centres of Vocational Excellence (CoVEs), whose ongoing efforts are instrumental in driving the success of this initiative.

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