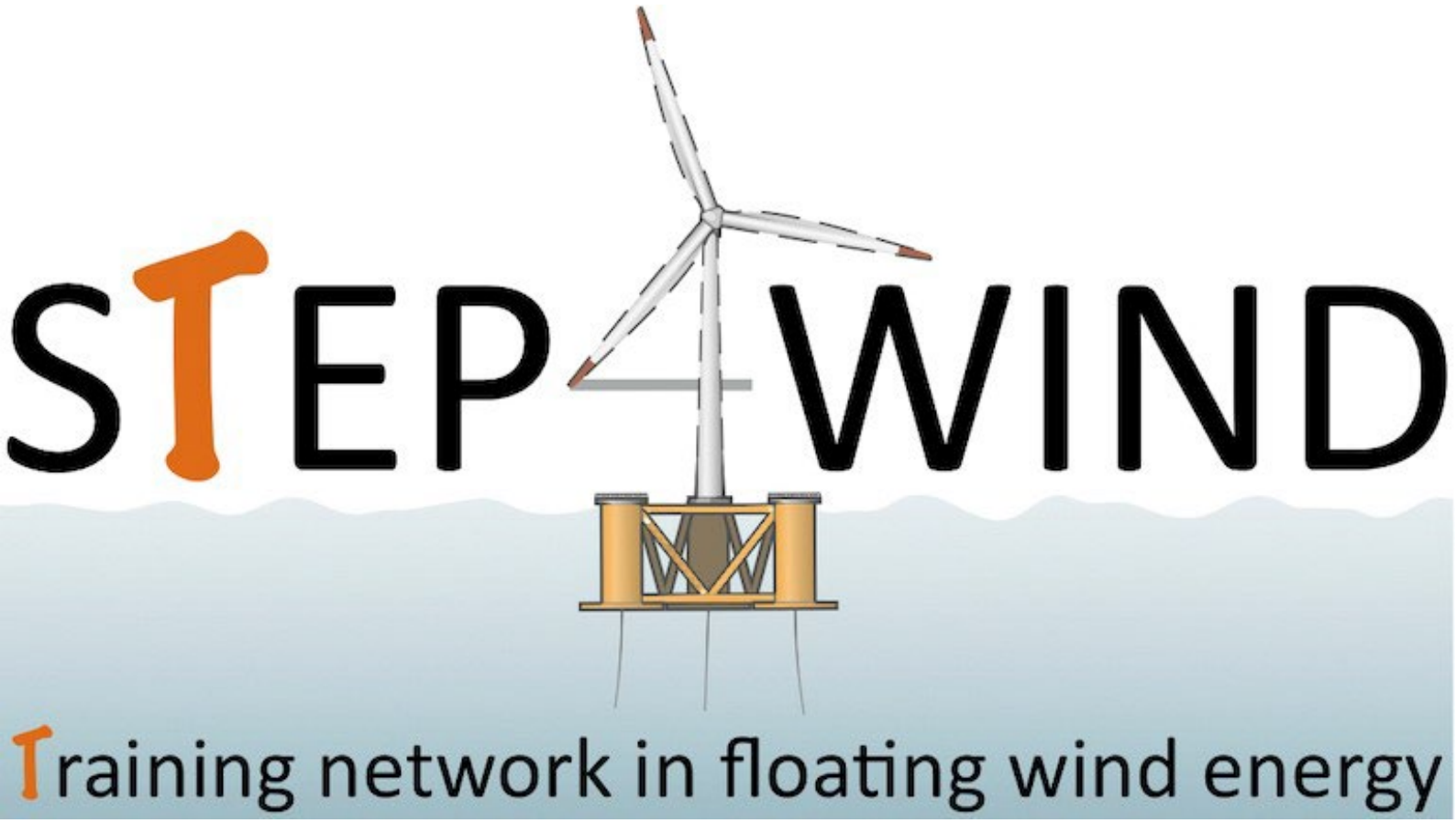
D4.4 Massive Open Online Course and Online Game

[Version 1.0]



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Document History

Revision Nr	Description	Author	Review	Date
1	First draft	Axelle Viré (TU Delft)		14/08/2024
2	Final version	Oana Trifan (TUDelft)	Internal review	29/08/2024

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1. Introduction

For many technical universities worldwide, educating a diverse student population continues to be a challenge. Research shows that building long-term teacher-scientist partnerships throughout the school curriculum can be effective in increasing the enrolment of minorities in STEM. It is also key to reach out to society at large, and especially involve schoolteachers and parents, in addition to pupils. Creating learning communities by connecting a large range of stakeholders, such as students, schoolteachers, professionals, policymakers, and citizens can be a powerful way to achieve this.

This deliverable presents some of the activities that have been developed by the STEP4WIND team and form building blocks that can be leveraged, in future initiatives, by a variety of stakeholders for example in learning communities. The document specifically focusses on presenting the development of (i) educational materials on floating offshore wind energy and (ii) an online game. These activities are part of the dissemination strategy of STEP4WIND and complement activities such as a design competition and more traditional dissemination activities such as the publication of journal papers and oral/poster presentations at international conferences.

The goal of the activities described here is to bring educational information about floating wind energy to a wide audience, such as BSc/MSc students, policy makers, and citizens. As explained in the project proposal, these dissemination activities have started to be developed as part of STEP4WIND. However, their development and use will continue well beyond the programme. Section 2 describes the open educational materials, whilst Section 3 focusses on the online game.

2. Educational materials

Floating wind energy is highly multi-disciplinary and a relatively new area. Additionally, floating wind turbines can be quite different from bottom-fixed wind turbines, for example in terms of dynamics, loads, and logistics. At the start of STEP4WIND, there were very little educational materials on floating wind energy specifically. But given the growth in the sector and the pace of development of these turbines, dedicated educational materials are needed. Thus, during the project, we decided to develop a range of materials targeting different stakeholders and with different purposes. This is detailed below.

2.1. Course for MSc students

The MSc course “AE4W31 Floating Offshore Wind Energy” was developed from scratch by Axelle Viré (STEP4WIND coordinator) and Delphine De Tavernier. The course is offered yearly since the academic year 2022-2023. For now, it is accessible only to TU Delft students as a pilot. However, the ambition is to open the materials to more students in the future, including professionals with the EdX platform. More details about the course can be found below.

2023/2024	Aerospace Engineering	Master Aerospace Engineering
AE4W31	Floating Offshore Wind Energy	ECTS: 3

Responsible Instructor	**Name** Prof.dr.ir. A.C. Viré	**E-mail** A.C.Vire@tudelft.nl
Instructor	**Name** Dr.ir. D.A.M. De Tavernier	**E-mail** D.A.M.DeTavernier@tudelft.nl
Contact Hours / Week x/x/x/x	0/0/0/2	
Education Period	4	
Start Education	4	
Exam Period	4 5	
Course Language	English	
Course Contents	This course introduces the topic of floating offshore wind energy, a fast-growing field in offshore wind energy, which consists in placing offshore wind turbines on a floating support structure. The course highlights the need for floating offshore wind, the main challenges compared to conventional bottom-fixed offshore turbines, and the impact on the industry as a whole. More specifically, topics covered in the course are: - Why floating offshore wind, ongoing projects and trends - Aerodynamics and control of floating offshore wind turbines - Hydrodynamics of floating offshore wind turbines - Small-scale and full-scale testing - Logistics and project development of large floating offshore wind farms - Alternative wind turbine concepts for floating foundations	
Study Goals	After completing the course, the students will be able to: - Explain the relevance and need for floating offshore wind energy in the current energy transition - Derive appropriate aerodynamic and hydrodynamic models for floating offshore wind turbines - Calculate the effect of a floating motion on the turbine performance - Define guidelines for testing floating offshore wind turbines in wind tunnels and wave tanks - Explain the industrial challenges in developing a large floating offshore wind farm - Explain the differences between bottom-fixed and floating turbines in the overall supply chain - Explain pros and cons of different wind energy concepts in a floating environment	
Education Method	The course consists of live lectures, assignments and self-study materials on Brightspace. Guest lecturers from industry and other Faculties/Universities will also participate in the course to reflect the multi-disciplinary nature of floating offshore wind energy.	
Assessment	The course is assessed through a written exam at the end of the course and the assignments performed during the course.	

Figure 1. Course content and study goals of the course AE4W31 developed by the STEP4WIND coordinator during the project.

Additionally, we supported student teams in their participation to the International Floating Wind Competition in 2022 and 2023. One of our teams won a 1000 Euros prize for their work (Fig. 2). A movie of the aftermath is available openly online (here).

Figure. 2. Student team supported by the STEP4WIND supervisors at TU Delft and winning a prize at the International Floating Wind Competition (2022).

2.2. Outreach activities for citizens (adults and children)

In addition to targeting university students with the MSc course, we initiated a series of outdoor outreach activities during the summer weeks (from June to September) on the beach of The Hague and on lakes in Delft. This has been taking place on a yearly basis since 2021, leading to This is made possible through a collaboration with OffshoreWind4Kids established with TU Delft in 2021. The PhD candidates of STEP4WIND, as well as staff at TU Delft, supported these activities by building scaled model of floating wind turbines and testing them at sea. A photo of model testing at sea is shown in Figure 3.

Figure 3. Example of floating wind turbines built with families at the beach of Scheveningen (19 Sept 2021).

Arrows show floating wind turbine models built by the citizens and tested at sea.

We also participate at open fairs on a regular basis, for example at the Day of Sustainability in Delft in 2021 (Figure. 4).

Figure 4. Example of open workshops on floating wind energy at the public library in Delft (10 October 2021).

2.3. Interview and short lectures

The project members of STEP4WIND also disseminated their knowledge to widely accessible media. Our project coordinator was notably interviewed by De Telegraph, the most widely read national newspaper in The Netherlands, to talk about floating wind energy in an article published in May 2022, and by the New Energy for Europe (see here). More recently, in Aug 2024, she talked about the challenges and opportunities of floating wind energy in the popular science magazine Quest (Fig. 6). Several short videos and guest lectures were also given to the public, for example on floating wind and hydrogen production (here).

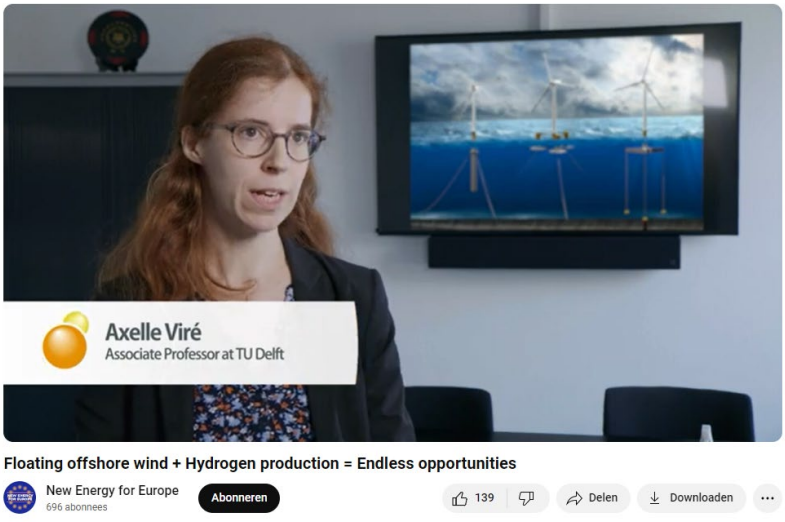

Figure. 5. Project Coordinator, Axelle Vire interviewed on floating wind energy for green hydrogen production at sea (Apr. 2021)


Quest Windpark op zee: hoe wordt dat gebouwd? Premium

Tech / Technologie

Windpark op zee: hoe wordt dat gebouwd?

Voor het eerst produceert de Europese Unie meer elektriciteit uit zon en wind dan uit fossiele brandstoffen. En er worden alleen maar meer windparken op zee gebouwd. Een technische prestatie op zichzelf, want hoe bouw je eigenlijk een kaarsrechte windturbine dobberend op zee?

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Figure 6. Example of media article where our project members were interviewed to talk about floating wind energy (Aug. 2024)

3. Online game

In addition to the educational materials described above, we developed an online game on designing offshore wind farms. The main objectives of the game are to: (i) disseminate the programme in a fun way to a wide audience, (ii) train students and the general public, and (iii) increase social acceptance of offshore wind energy. In the current version of the game, players can use the offshore space in the North Sea to place wind turbines and design a farm. By choosing the size, rated capacity, number, and locations of the turbines, the game computes the levelized cost of electricity of the proposed farm. The game interface runs a simplified version of the MDAO framework developed by ESR4. Snapshots of the game interface are shown in Fig. 7. In the academic year 2024-2025, the game will be further extended to improve the graphics with coastlines and add inputs from the player.

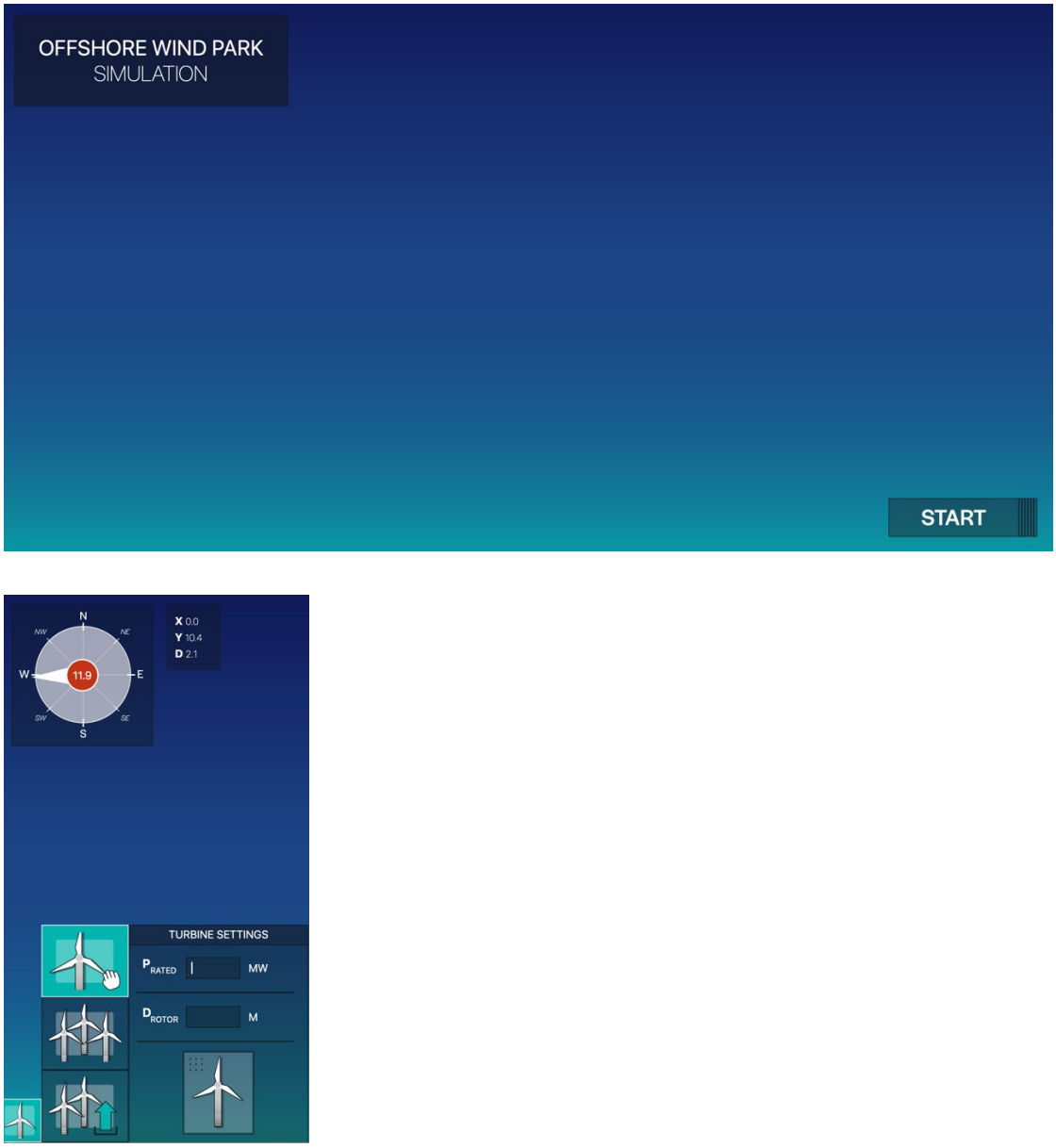

Figure.7. Snapshots of the online game interface linked to the MDAO framework developed by ESR4 within STEP4WIND.