Working Group 2 (WG2)
MODULAR OFFSHORE FLOATING ENERGY ISLANDS

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MODENERLANDS

25-26 March 2024
Kaunas, Lithuania

MODENERLANDS WG2 future meetings

Technological challenges and solutions addressing the aspects of **modularization**

Floating systems **technology development** for energy platforms

Wind/wave/current structural interaction and loading of floating platforms (FSI problems)

Fabrication and execution aspects

Operational functionality, structural health and condition **monitoring**

Regulatory and standardization

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Past meetings and activities

Coimbra, April 2022

	Date	No participants
1	14 June 2022	13
2	2 September 2022	21
3	10 January 2023	13
4	14 February 2023	16
5	20 March 2023	15
6	18 April 2023	15
7	22 May 2023	17

WG2 online meetings

Luxembourg, May 2023

Istanbul, September 2023

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Past meetings - OUTCOME

- **31 authors**
- **19 institutions**
- **14 countries**

Offshore renewable energies: a review towards Floating Modular Energy Islands. Part 2 - Monitoring, Loads, and Control

Enzo Marino[a], Michaela Gkantou[b], Abdollah Malekjafarian[c], Seevani Bali[d], Charalampos Baniotopoulos[e], Ruben Paul Borg[f], Niccoló Bruschi[a], Philip Cardiff[d], Eleni Chatzi[g], Ivan Čudina[h], Florin Dinu[i], Evangelos Efthymiou[j], Giulio Ferri[a], Helena Gervásio[q], Junlin Heng[e], Zhiyu Jiang[k], Stefano Lenci[l], Ivan Lukačević[h], Lance Manuel[m], Angela Meyer[o], Mariela Méndez Morales[q], Adnan Osmanović[p], Vikram Pakrashi[d], Amiya Pandit[c], Giuseppe Rega[n], Davor Skejić[h], Luana Tesch[q], Viorel Ungureanu[i], Tarik Uzunović[p], Amrit Shankar Verma[r]

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[g]Dep. of Civil, Env. and Geomatic Eng., ETH Zürich
[h]Faculty of Civil Engineering, University of Zagreb, Croatia
[i]Politehnica University of Timisoara
[j]Institute of Metal Structures Dept. Civil Eng., Aristotle University of Thessaloniki
[k]Dept. of Engineering Sciences, University of Agder
[l]Dept. of Civil and Building Engineering, and Architecture, Polytechnic University of Marche, Ancona, Italy
[m]Dept. of Civil, Architectural and Environmental Engineering, The University of Texas at Austin, USA
[n]Dept. of Structural and Geotechnical Engineering, Sapienza University of Rome, Italy
[o]Dept. of Geoscience and Remote Sensing, TU Delft
[p]Faculty of Electrical Engineering, University of Sarajevo, Bosnia and Herzegovina
[q]University of Coimbra, ISISE, ARISE, Dept. of Civil Engineering, Coimbra, Portugal
[r]Department of Mechanical Engineering, University of Maine

Offshore renewable energies: a review towards Floating Modular Energy Islands. Part 1 - Materials, Construction, and LCA

Enzo Marino[a], Michaela Gkantou[b], Abdollah Malekjafarian[c], Seevani Bali[d], Charalampos Baniotopoulos[e], Jeroen van Beeck[s], Ruben Paul Borg[f], Niccoló Bruschi[a], Philip Cardiff[d], Eleni Chatzi[g], Ivan Čudina[h], Florea Dinu[i], Evangelos Efthymiou[j], Giulio Ferri[a], Helena Gervásio[q], Junlin Heng[e], Zhiyu Jiang[k], Stefano Lenci[l], Ivan Lukačević[h], Lance Manuel[m], Angela Meyer[o], Mariela Méndez Morales[q], Adnan Osmanović[p], Vikram Pakrashi[d], Amiya Pandit[c], Giuseppe Rega[n], Davor Skejić[h], Luana Tesch[q], Viorel Ungureanu[i], Tarik Uzunović[p], Amrit Shankar Verma[r]

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[j]Institute of Metal Structures Dept. Civil Eng., Aristotle University of Thessaloniki
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[r]Department of Mechanical Engineering, University of Maine, USA
[s]von Karman Institute for Fluid Dynamics

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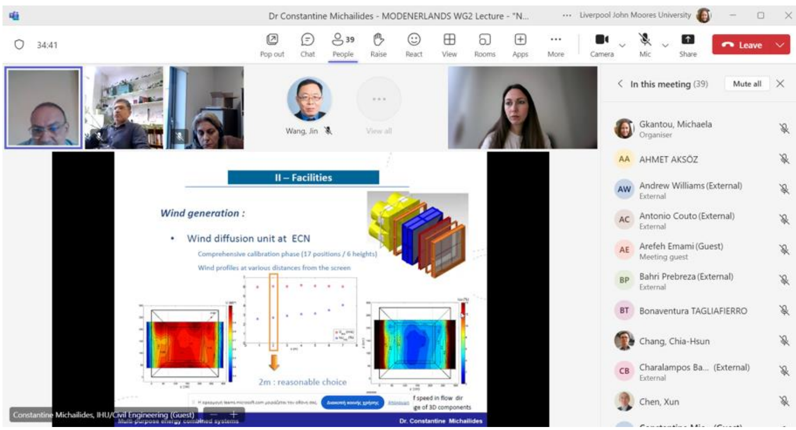
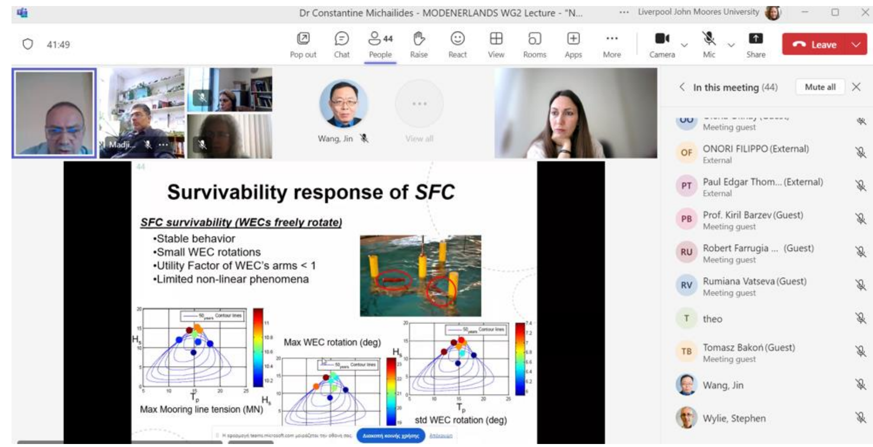
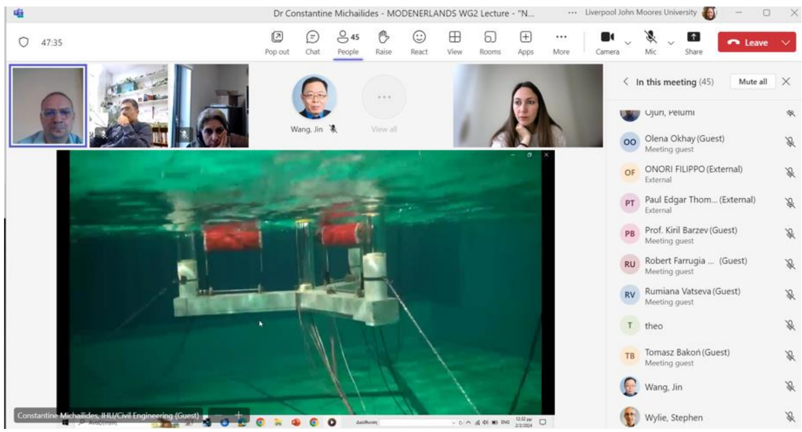
WG2 Webinar – 2 February 2024







Dr Constantine Michailides

Numerical analysis and testing of multi-purpose energy combined systems

45 attendees

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MODENERLANDS WG2 topics

NOW-

WG2 Meeting Lithuania

25-26 March 2024

WG general meeting in Kaunas, 25-26 March 2024

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WG2 Participants 25-26 March 2024

	Participant	University	Country
1	Michaela Gkantou	Liverpool John Moores University	United Kingdom
2	Charalampos Baniotopoulos	University of Birmingham	United Kingdom
3	Stefano Lenci	Polytechnic University of Marche	Italy
4	Bonaventura Tagliafierro	Universitat Politècnica de Catalunya	Spain
5	Ivan Sokol	University of Zagreb	Croatia
6	Sabri Alkan	Bandırma Onyedi Eylül University	Turkey
7	Jonas Thor Snæbjörnsson	Reykjavik University	Iceland
8	Tarik Uzunović	University of Sarajevo	Bosnia and Herzegovina
9	Giuseppe Failla	University of Reggio Calabria	Italy
10	Ahmet Aksöz	Sivas Cumhuriyet University	Turkey
11	Marin Ivanković	University of Zagreb	Croatia
12	Osman Kümük	Iskenderun Technical University	Turkey
13	Daniel-Viorel Ungureanu	Polytechnic University Timisoara	Romania

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WG2 presentations

Stefano Lenci

New results for the internal resonance of FOWT

Key points:

- Two different models for the sea wave excitation are considered in the framework of a reduced-order model of FOWT
- The **pitch rotation** is shown to furnish a negligible contribution to the essential resonant dynamics, due to the high stiffness value needed to guarantee the occurrence of the internal resonance
- The **heave displacement,** modelled as parametric excitation, shows to significantly increase the response amplitude, and an enrichment of the system dynamics for low values of the wind excitation

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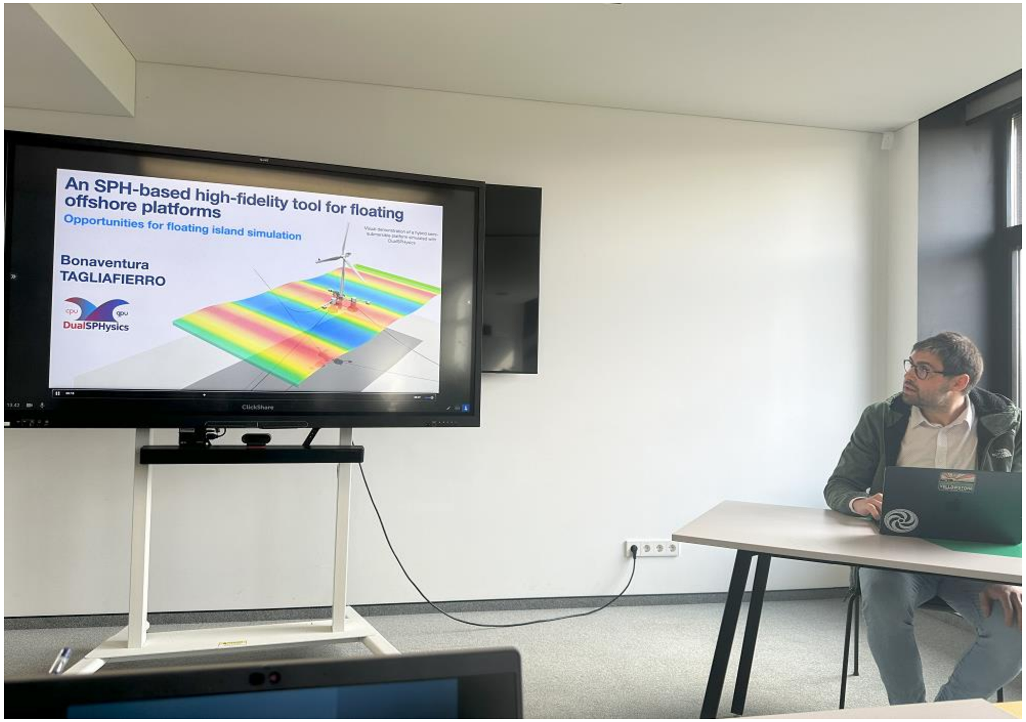
WG2 presentations

Bonaventura Tagliafierro

An SPH-based high-fidelity tool for floating offshore platforms: opportunities for floating island simulations



<u>Key points:</u>

- Smoothed Particle Hydrodynamics
- Applicability
  - Wavestar
  - FOSWEC
  - DeepCwind
  - Semi-sub and Wavestar
  - Floating islands

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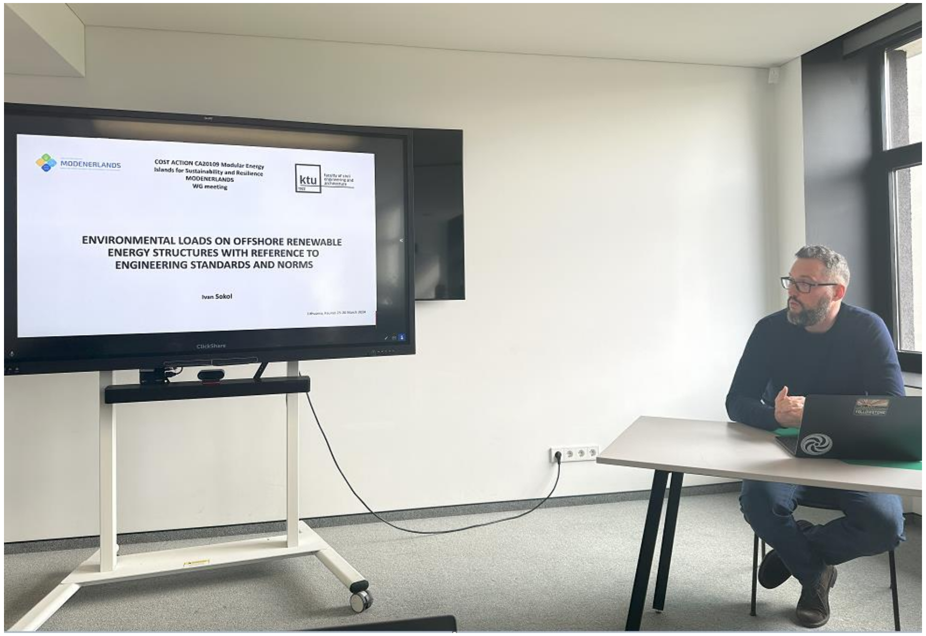
WG2 presentations

Ivan Sokol
Environmental loads on offshore renewable energy structures with reference to engineering standards and norms

- **<u>Key points:</u>**
- Exhibited discrepancies between RULE BASED APPROACH and REALISTIC WIND CONDITIONS
- Dominant x displacement is underestimated by RULE BASED APPROACH by almost 60%
- Moment R my minimum and maximum value differ by 60% and 34%
- Substantial implications for the structural design (limit strength and fatigue analysis



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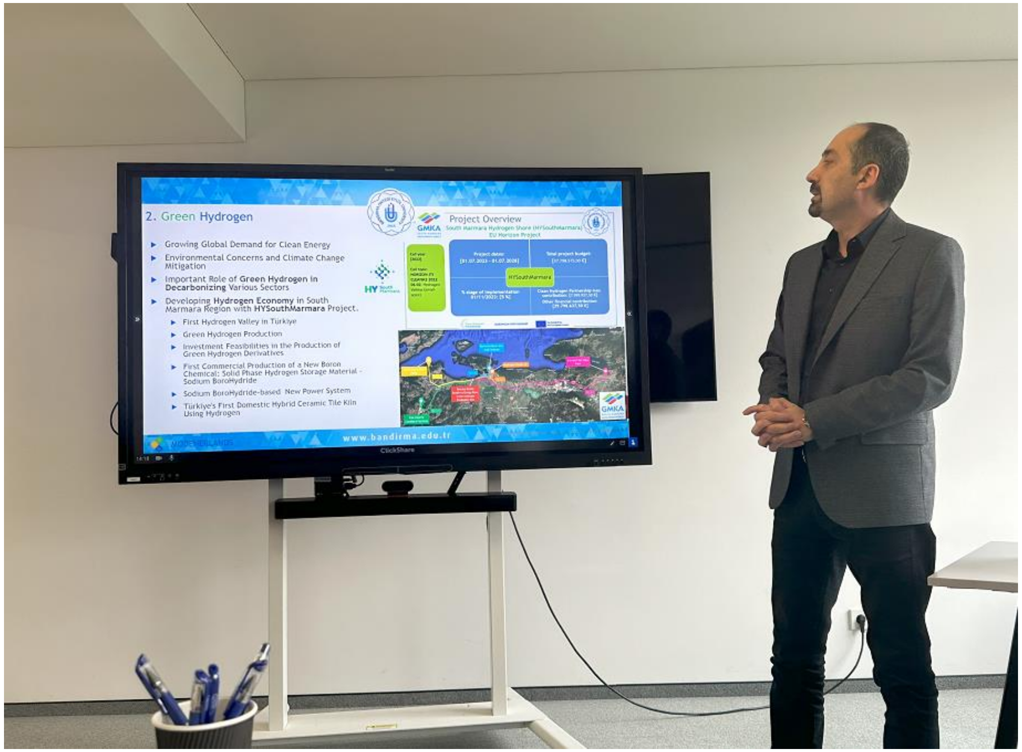
WG2 presentations

Sabri Alkan

Consideration of Natural Islands in the Sea of Marmara (Türkiye) for Green Hydrogen Generation through Offshore Wind Energy



<u>Key points:</u>

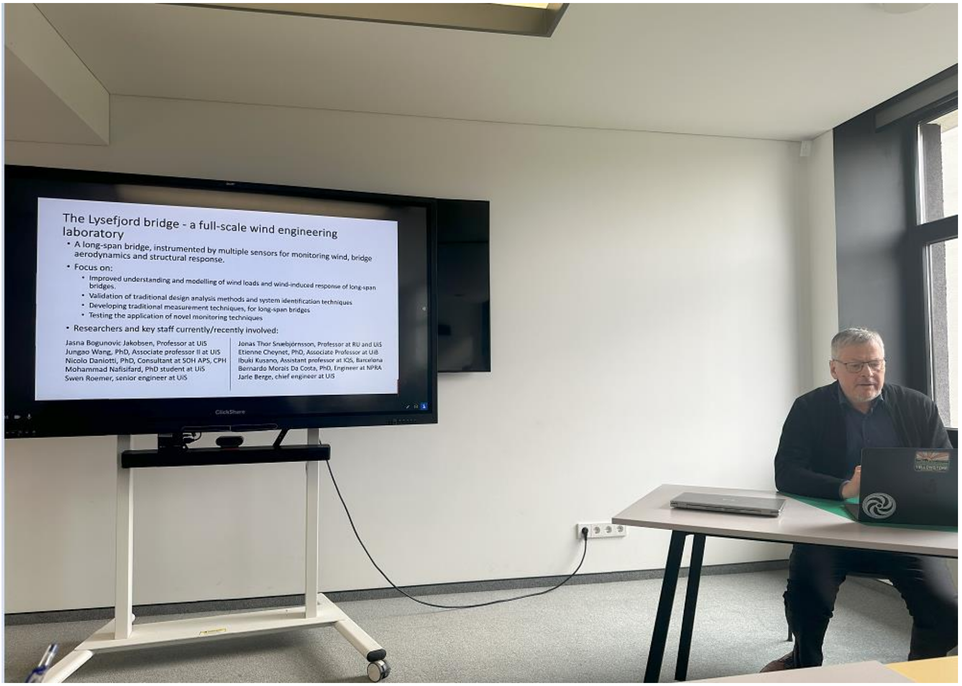
- Need for Green Hydrogen
- Offshore Wind & Natural Islands (Marmara region)
- Integration Offshore Wind & Hydrogen
- Ports & Islands for Decarbonization
- STSM in Norway

WG2 presentations

Jonas Thor Snæbjörnsson
Long term monitoring of wind excitation and response of a wind sensitive structure

Key points:

- The Lysefjord bridge - a full-scale wind engineering laboratory
- Instrumentation
- Pressure measurement system
- Lidar campaigns in 2014 and 2021
- Influence of the local topography on the mean flow conditions recorded on the Lysefjord bridge
- Monitoring real structures is important



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25-26 March 2024, WG2 meeting, Lithuania

WG2 presentations

Tarik Uzunović
Electrical aspects of FEI

Key points:
- Electrical energy sources in FMEI
- Microgrid
- HES Control system
- Robustness with respect to internal and external disturbances is desired.

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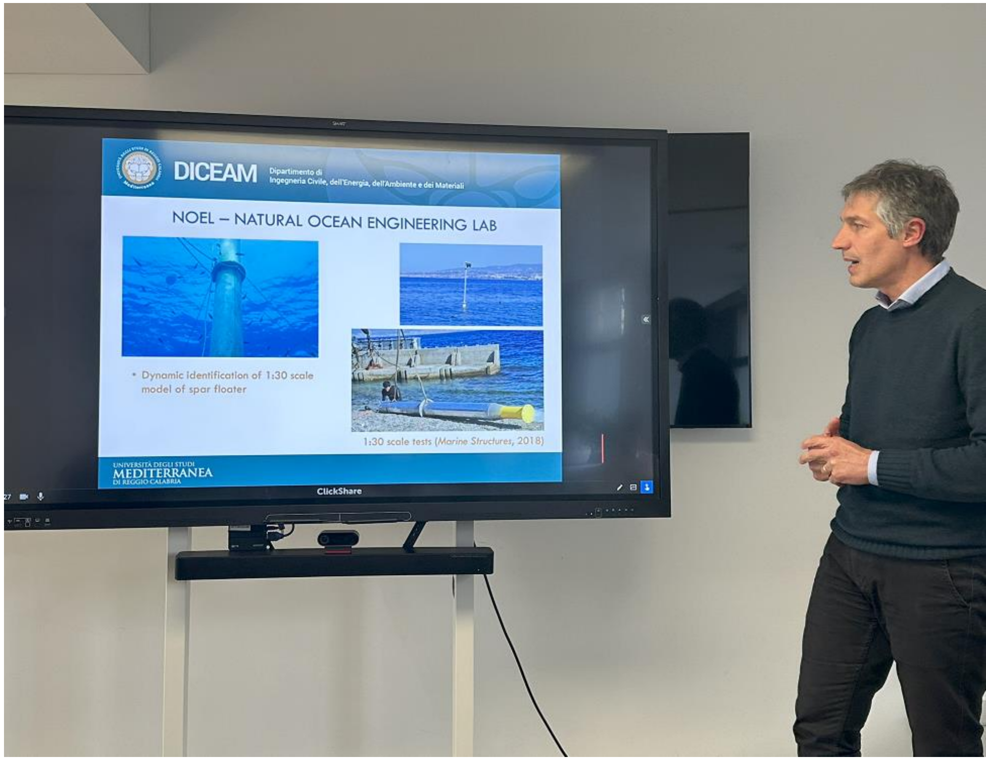
WG2 presentations

Giuseppe Failla
Vibration mitigation devices for offshore wind turbines



Key points:
- TUNED MASS DEVICES (TMD)
- TWO-DEGREE-OF-FREEDOM TMD
- FLOATING ABSORBER
- Application of tuned mass devices or inerter based devices to mitigate motion of floating platforms
- NOEL NATURAL OCEAN ENGINEERING LAB
- BLUE GROWTH FARM - HORIZON 2020

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WG2 presentations

Ahmet Aksöz

Black sea Floating Offshore Wind and Offshore Wind Turbines

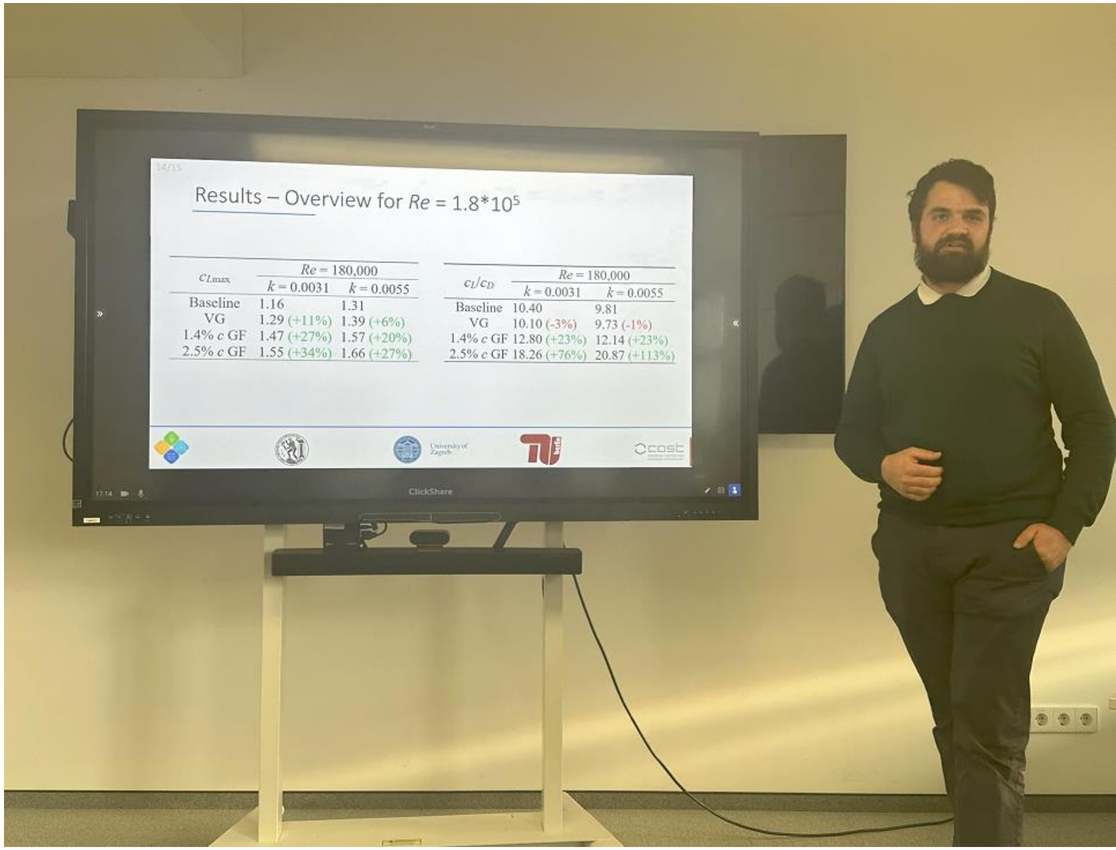
<u>Key points:</u>

- Project BLOW aims at unlocking the Black Sea fLoating Offshore Wind potential, by demonstrating a disruptive **cost-efficient floating integrative unit design optimised for low and medium wind speed** areas.
- BLOW will implement a 5 MW demonstrator in the Black Sea and will pave the way to industrial mass production and to the deployment of floating offshore wind farms.
- BLOW targets an expected LCOE of 87€/MWh by 2028 (and 50€/MWh beyond 2030) and an environmental impact reduced by 40%.

WG2 presentations

Marin Ivanković

- *ERIES-CRANES, wind effects on harbor cranes*
- *Wind turbine aerodynamics*



<u>**Key points:**</u>

- Wind loading measurements on model
- scale harbour cranes & CFD
- Improvement of airfoil aerodynamic characteristics
- Experimental set-up
- Experimentally confirmed that using Vortex generators or Gurney flap on improve its aerodynamic behaviour by

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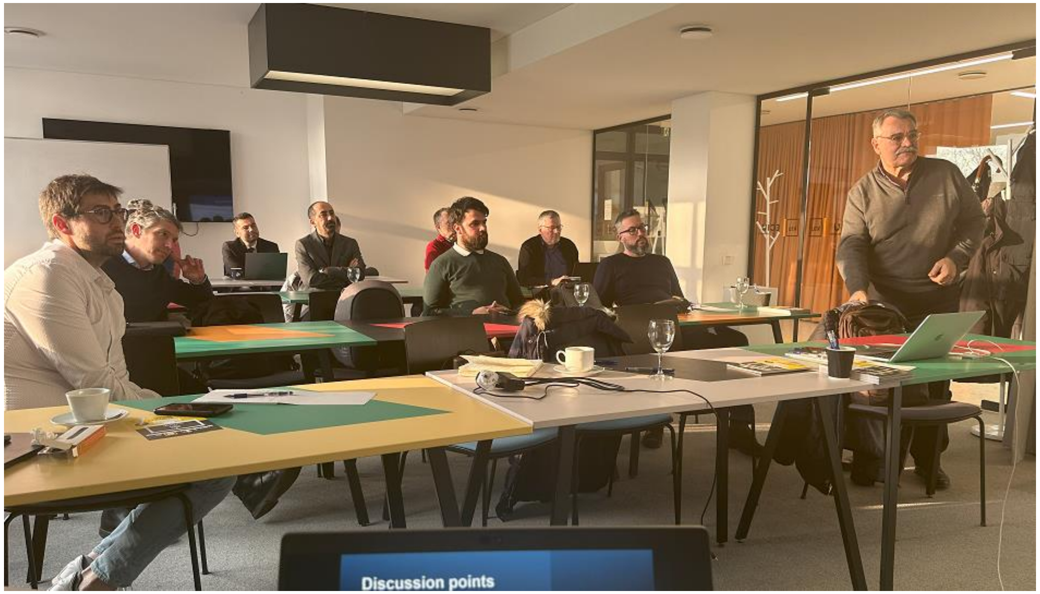
Discussions



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Agenda

26 March 2024 (Tuesday)		
Time	Presenter	Topic
09:00-10:30	WG2 members	Round Table moderated by MG and CB: - Coordinating the subgroups activities and promoting their interactions. - Identification of possible calls for research proposals. - Actions planning. Definition of two or more thematic subgroups (e.g., materials, dynamics, etc.). Each subgroup is expected to: - Identify one or more priority research topics to be addressed jointly. - Identify one or more reference persons who will lead the research activities. - Identify the key strategies for an effective implementation of the research (e.g., joint papers, periodical online meetings, conferences, STSMs, co-supervision of Master/PhD projects, etc.).
10:30-11:00	Coffee Break	
11:00-13:00	Plenary meeting	
11:00 – 11:20	Prof. Andrius Jurelionis Dean of the Faculty of Civil Engineering and Architecture, KTU Introduction of Faculty's research activities and studies	Amphitheatre, Library
11:20 – 11:50	Darius Žebrauskas Head of Innovation at EPSO-G Lithuania Energy Vision to 2050	Amphitheatre, Library
11:50 – 13:00	Core group meeting (overview of the work developed and results achieved)	Amphitheatre, Library

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Presentation of four main routes

- Based on discussions on **WG2 meetings in Istanbul, September 2023**
- FMEI: Floating Modular Energy Islands

- **TASK 1:** Architecturing FMEI: Defining optimal shape of each single modulus, topology of the assembled moduli, mooring systems. (18 interested members based on WG2 online meeting on 23/02/2024)
- **TASK 2:** Engineering FMEI: Simulations/Reliability and Digitalisation (19 interests members based on WG2 online meeting on 23/02/2024
- **TASK 3:** Constructing FMEI: Selection of optimal materials and manufacturing techniques, logistics. (8 interests members based on WG2 online meeting on 23/02/2024)
- **TASK 4:** Griding FMEI: Electrical aspects/Storage (1 interest based on WG2 online meeting on 23/02/2024)

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Future in person WG2 meetings

- **Strategic workshop, 2-3 September 2024, Bochum, Germany**
- **MODENERLANDS International Conference, September 2025**

Training School – Belgrade 18-21 June 2024

WG2 is organising this year’s training school!

CONCEPTUAL DESIGN OF FLOATING ENERGY ISLANDS FROM TRADITIONAL CONCEPTS TO DIGITAL-TWINS DRIVEN DESIGN

Description
The aim of the school is training new skills for early-stage researchers and PhD students, decision-makers, promoters, and local development facilitators working with new and innovative sustainable energy systems. The training school integrates multi-disciplinary knowledge related to modular artificial islands, the assessment of sustainable energies resources for energy islands, and network energy storage and resilience, boosting new job profiles on sustainable energy technology, strategic planning, transition planning and management. During the training school, there will be lectures on various topics, such as modular structures, offshore structural dynamics, structural health monitoring, life cycle assessments and structural digital twins. The school will also include workshop sessions, promoting innovative thinking, formulated in a practice-oriented modulation, and aimed at shaping processes of strategic dialogue, co-evolution and co-creation.

Venue
University of Belgrade, Belgrade, Serbia

Application
The Training school is primarily addressed to MSc and PhD students, early-stage researchers, young academic staff, and industry technical staff working on sustainable energy systems.

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Discussion points

1. **Any STSM based on presentations shown today for yourselves or any researchers?**
    - Bonaventura to check for mobility (PhD student or himself), maybe Bonaventura to Tarik
    - Stefano Lenci to check collaboration with Panos Alevras TUC
    - Lambis Baniotopoulos to check for STSM in Turkey
    - Marin to check for STSM in Berlin

2. **Establish collaboration for a joint WG2 webinar?**
    - Junlin Heng, already planned, digital twins for offshore wind turbines, prognosis for corrosion-fatigue
    - Marin to present on aerodynamics for half a session, maybe to check with von Karman Institute

3. **Volunteer for task leader for the previously defined tasks?**
    - TS to be aligned with the four tasks
    - To check electrical engineering experts from Belgrade for input to TS

Discussion points

4. Any other subgroups based on the presented research of this meeting?

__**Subtasks:**__

- **Structural vibration:**
  - **Stefano Lenci**, Panos Alevras, Vikram, Giuseppe Failla
- **Digital twins:**
  - Junlin Heng, Georgios Stavroulakis, Lampis Baniotopoulos, **Michaela Gkantou,** Jonas Thor Snæbjörnsson
- **Griding:**
  - **Tarik,** Bonaventura, WG3 members (Michaela to check and confirm)
- **Circularity (reuse, recycling & repowering) in wind energy structures:**
  - **Viorel,** Michaela, Lampis Baniotopoulos, Sabri, Stefano Lenci

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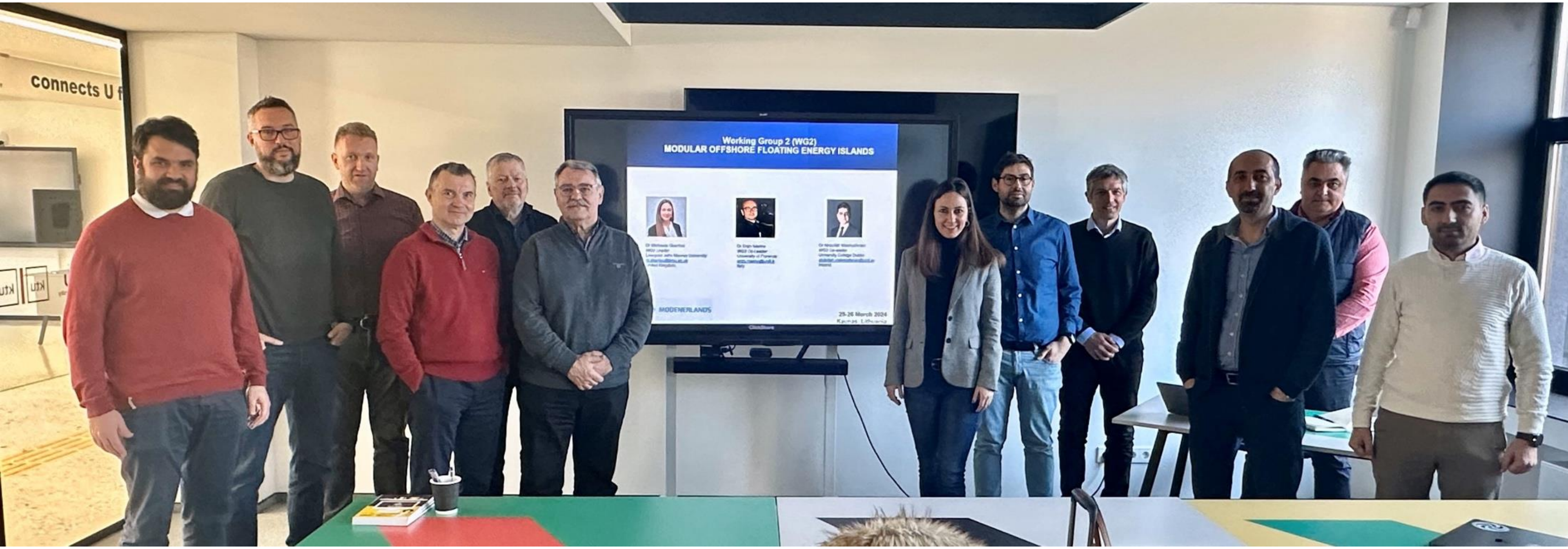
Discussion points

5. Joint masters/PhD students (supervision/external examination).

6. Acknowledgement for the Action of relevant papers with contributions from different countries, if relevant and supported by the action

7. Research proposal: EU Funding & Tenders Portal (europa.eu)

Thank you!!



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25-26 March 2024, WG2 meeting, Lithuania

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Thank you!

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