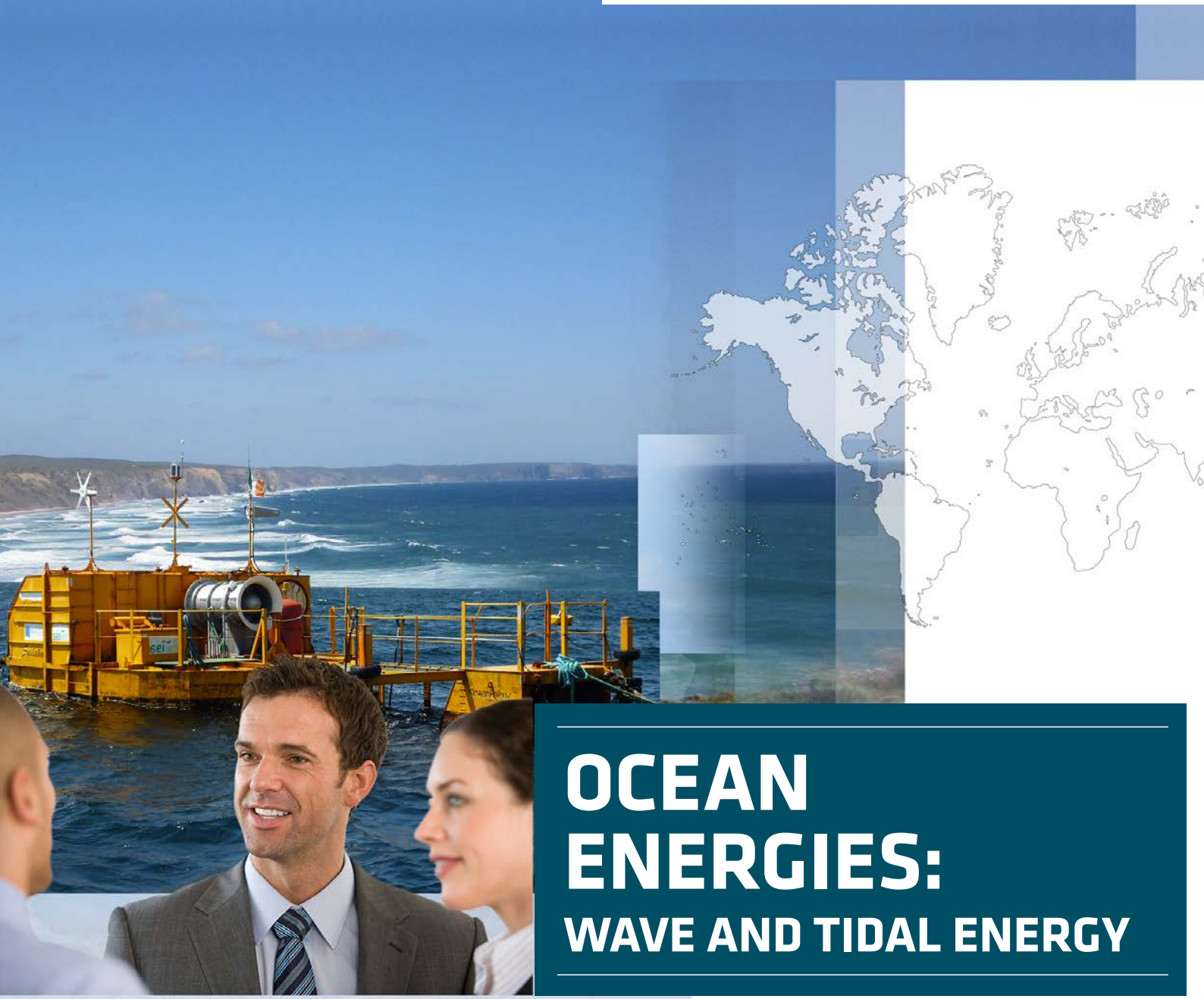
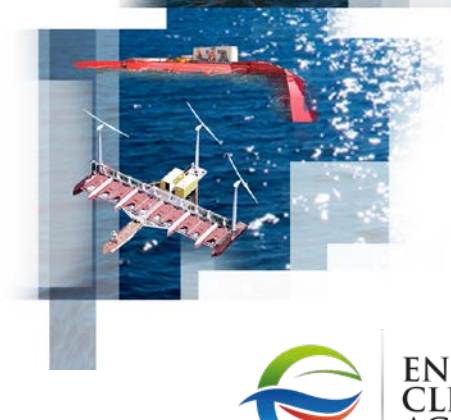
4 X 1 DAY COURSES ON OCEAN ENERGIES



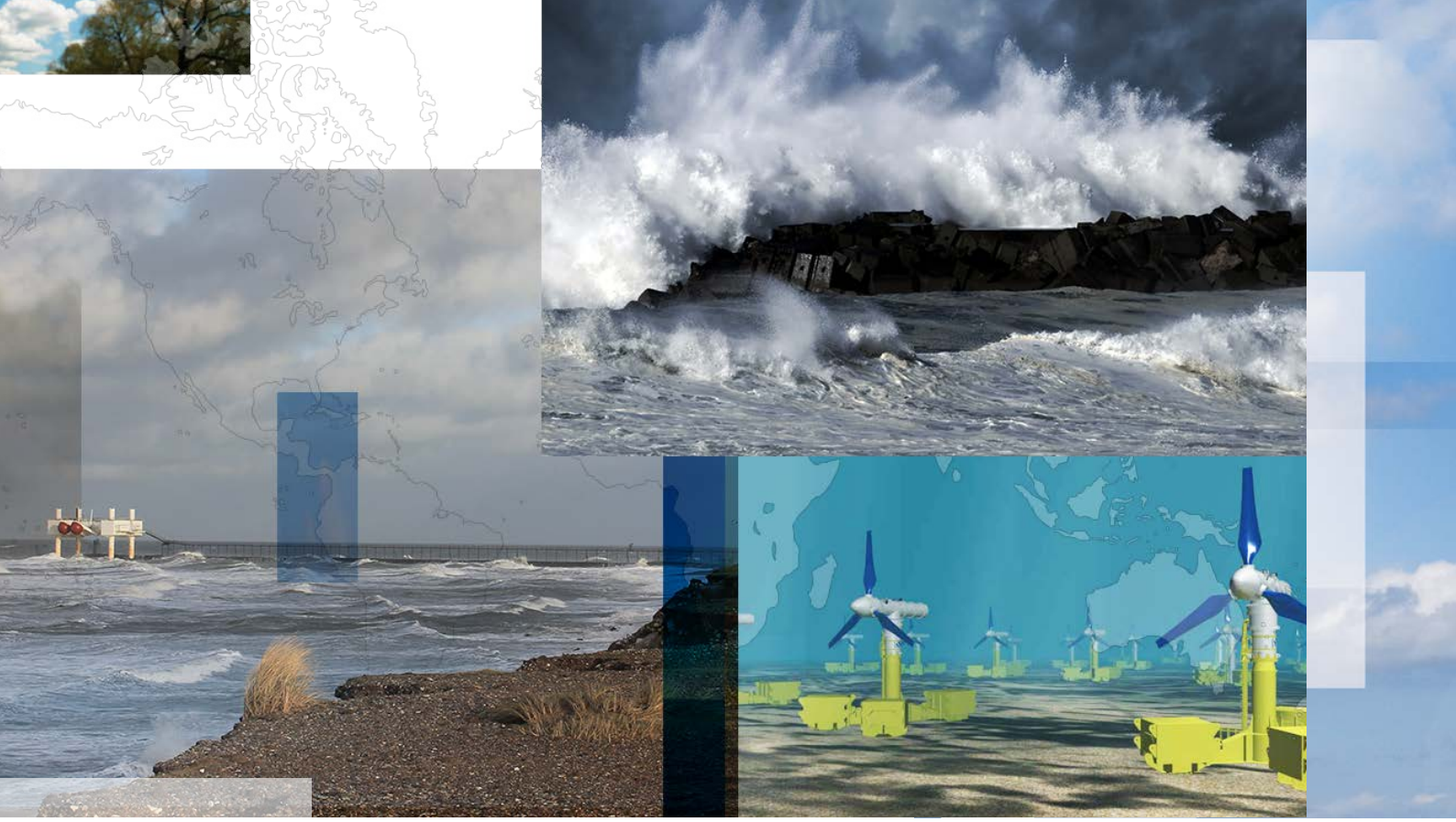
OCEAN ENERGIES:
WAVE AND TIDAL ENERGY



ENERGY AND CLIMATE ACADEMY

IN COOPERATION WITH

Danish Partnership for **Wave Power**



OCEAN ENERGY

Program Purpose and Format:
The courses aim at providing an overview over what technologies, companies and investors are involved in the ocean energy sector, and what are the economic and technical potential, as well as future projections, of wave and tidal energy. Course attendants will get a detailed overview of the state of the art of the wave and tidal energy sectors, and by the end of the course will be able to identify the main opportunities, challenges, financial aspects and key actors in the sector, as well as to understand a broad range of technical terms and the physics related to generating electricity from ocean waves and tidal currents.

The Ocean Energy Seminar has been thought as four independent course days, which can be combined as a participant wants it.

A four-day full-course is proposed, with the advantage that the participant can choose how many days to participate depending on his interest, i.e. three of the four days, the first and second day, or only the last day, for example.

Lectures build up on several years' experience and research on ocean energies. Lectures also assure the most updated knowledge and detailed overview of the very recent activities and developments within the ocean energy sector and its technologies.

Program Objectives:

By the end of this course the attendants will be able:

- To evaluate and quantify the potential of ocean energies, and to differentiate among them.
- To understand the functioning of the different wave and tidal energy technologies that exist today, and to evaluate their advantages and disadvantages.
- To evaluate the feasibility of a wave, tidal and hybrid wave and wind project in a specific location looking at the long-term perspective.
- To assess the economic and business potential of a technology.
- To gain a solid foundation of the international experiences in developing wave and tidal energy, and the support received by the EU.
- To understand what organizations, companies, developers, etc. are involved in the ocean energy sector, and which role they play.
- To assess the potential of ocean energies in future and smart energy systems.

Introduction to Ocean Energies — Day 1

The first day will focus on understanding the different types of ocean energies (wave energy, tidal barrage and tidal stream, OTEC and salinity gradient), their current status and potential. We will review the most important technologies and different working principles, with their present challenges and lessons-learnt. A market outlook for wave and tidal energy will be presented focusing on the technologies of tomorrow and market projections.

Understanding ocean energies, current status & potential
- Salinity gradient
- OTEC
- Tidal barrage and Tidal stream
- Wave energy

Wave energy and Tidal Energy: Technologies
- Wave energy devices
- Tidal turbines
- Market Status
- Present Challenges & lessons-learnt

Market outlook
- The technologies of tomorrow
- The future role of test sites in Europe
- Key countries and initiatives in the Atlantic Arc
- Market projections

The Business Case of Wave and Tidal Energy — Day 2

On the second day we will focus on the economics and finances of wave and tidal energy. We will present current costs, opportunities of cost reductions and future projections. The LCOE parameter will be analysed and compared with other renewable technologies and conventional energies. We will review current financial models (European and national instruments, international projects, and main investors) and the innovation cycle from start-up to commercialisation of key technologies. Finally the Danish COE Tool for wave energy converters will be presented and utilised.

- The cost of wave and tidal energy, LCOE
- LCOE comparison with competing technologies
- Financial models: European instruments, international projects, investors and main actors
- The innovation cycle from start-up to commercialisation of key technologies
- The LCOE Calculation Tool for wave energy converters

Course Tuition:
750€ per day including materials, meals

Registration and venue:
www.energyandclimateacademy.com

Behind the Physics of Wave and Tidal Energy — Day 3

On the third day the focus will be technical, targeting the physics of wave and tidal energy. We will introduce the basics of ocean dynamics, of WEC's dynamics, advanced wave analysis, numerical modelling, modelling tools, and some control basics. On tidal theory we will address the energy content of tidal currents and how we describe tides and tidal currents.

Introduction to ocean dynamics
- Regular waves
- Irregular waves

Interaction between WECs and ocean waves
- 3D radiation-diffraction codes (WAMIT)

Dynamics of WECs
- Frequency domain analysis
- Time domain analysis

Advanced wave analysis
- Reflection analysis of waves
- Short term wave prediction
- Control basics

Introduction to tidal theory
- Describing tides and tidal currents
- Energy content of tidal currents

Synergies of Offshore Wind and Wave energy, EIA and Public Opinion — Day 4

On the fourth day we will introduce the economic and technical advantages in combining offshore wind and wave energy in the same structure and/or location. The synergies in combining both resources will be analysed through a techno-economic case study based in North Sea waters. We will understand how both resources complement each other, and the economic as well as technical advantages of this combination, also from a grid and energy systems' perspective. This day will also cover the Environmental Impact Assessment (EIA) of a wave energy project and public opinion and acceptability of wave energy.

Combined wind & wave technologies
- Key technologies
- Present Challenges & lessons-learnt

Combined Offshore Wind energy farms & Wave energy arrays
- Synergies
- Economic advantages
- Technical advantages - grid perspective
- Technical advantages - back-up capacity & energy systems perspective
- North Sea Case Study of a combined Wind & Wave Energy Farm

Environmental Impact Assessment of Ocean energy projects
- EIA of a wave energy project
- Public opinion and acceptability of wave energy

Der kan forekomme ændringer til programmet

The Faculty

JULIA F. CHOZAS
PH.D. IN WAVE ENERGY, M.SC. POWER SYSTEMS ENGINEER, CHIEF LECTURER AND COURSE LEADER

Julia has co-authored several leading projects on wave economics, benchmark analyses and combined wind and wave power, while being part of a continuous training to universities and the industry on marine energies. Since 2013 she works as a Lead Engineer and Consultant for the wave and offshore wind industries in her company with world wide clients.

KIM NIELSEN
CIVIL ENGINEER, PH.D. IN WAVE ENERGY 1983 FROM DTU.

Kim Nielsen has through active involvement, for more than 35 years gained comprehensive experience in re-search and development of wave energy systems, numerical models and model experiments on wave power conversion in laboratories as well as in open sea. Through these and other projects, Kim has gained both technical and financial insight in the feasibility of wave energy plants.

MARCO ALVES
PHD IN MECHANICAL ENGINEERING, M.SC. IN MECHANICAL ENGINEERING AND MSC IN MANAGEMENT AND STRATEGY

Marco is currently the head of numerical modelling at WavEC and former visiting researcher at the Imperial College, London. His track record has been focused on the development and application of numerical tools to analyze the interaction between ocean waves and floating structures (floating breakwaters, wave energy converters, bottom fixed and floating wind turbines) or costal structures. He holds key expertise on several scientific fields including engineering control systems, linear and nonlinear numerical simulations, fluid dynamics, costal engineering and dynamics of floating bodies. Marco has extensive experience in supporting developers of marine renewable technologies.

JENS PETER-KOFOED
HEAD OF DIVISION, ASSOCIATE PROFESSOR, M.SC., PH.D.

Jens Peter is associate professor at Aalborg University, Department of Civil Engineering. He graduated from Aalborg University in 1997 with a M.Sc. in Civil Engineering, on “Hydraulic evaluation of the wave energy converter Wave Dragon”. Since 1997 to present he has been working at Aalborg University, Department of Civil Engineering, primarily working in the field of wave energy utilization but has also been involve in coastal engineering projects. He is currently heading the Division of Reliability, Dynamics and Marine Engineering and the Wave Energy Research Group at the Department of Civil Engineering, and has over the past decade has been involved in testing and evaluating more than 25 wave energy concepts in wave tanks and real sea.

ERIK FRIIS-MADSEN
CEO, WAVE DRAGON

MSc. Erik Friis-Madsen is the inventor of the Wave Dragon and have worked with many aspects of wave energy development for more than 30 years. Erik has extensive hands-on experience from the construction of and 20.000 test hours with the grid connected floating Wave Dragon protype. He has monitored the development of most types of wave energy devices through many years – here is a somewhat controversial article of his: “Small is beautiful” – but will small WECs ever become commercial?”,

PETER SCHEIJGROND
OCEAN ENERGY EXPERT

My interest in marine renewables started during my engineering studies in Scotland in the nineties, where I was inspired by some of the leading marine energy pioneers. Later at Ecofys, over a period of 10 years, I developed the Wave Rotor technology. I started my own company dedicated to supporting the marine energy sector. Since 2012 I have helped DMEC to develop their test sites, run the EU MaRINET programme, and recently the MET-CERTIFIED project. I am a founding board member of the Dutch Energy from Water Association, EWA, and an active contributor to the IEC committees developing standards and certification schemes for marine energy convertors.

ANDERS KØHLER
CEO, FLOATING POWER PLANT

CEO of Danish Floating Power Plant and has been so for the last 4 years. Other positions are board member of UK subsidiary, board member of 3 commercial project companies with Irirsh project developer DP Energy and advisory to Bystrup. He has a Master in engineering (within Energy production), is PMI certified and holds 2 business degrees (bachelor lever) from Copenhagen business School. Anders has over 16 years of experience in project development, business development, engineering and project management and has the privilege of heading the commercialization of the FPP technology, together with its many partners.

HANS CHRISTIAN SØRENSEN
PHD AND BSC (DIRECTOR OF SPOK APS)

Hans Chr. Soerensen has the last 35 years worked in industries and institutes bringing research to business.
He is graduated as Ph.D., M. Sc. Civil Engineering from the Technical University of Denmark and has further a degree from Copenhagen Business School. In the last 24 years as CEO of his own consultant company SPOK ApS. He is chairman of the board of Wave Dragon companies. He has been involved in several offshore wind farms in Denmark, UK and other countries, among others as coordinator of the 40 MW Middelgrunden Wind Farm outside Copenhagen. He is founder and vice president European Ocean Energy Association to 2010 and member of the Board, Danish Wind Turbine Owners Association.

Der kan forekommer ændringer til programmmet