

WECANET COST ACTION CA17105: THE FIRST OPEN PAN-EUROPEAN COST NETWORK TACKLING CHALLENGES IN THE WAVE ENERGY SECTOR

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6 June 2019, Belgian COST Workshop, Brussels

ENERGY & ENVIRONMENTAL CHALLENGES

Climate Change... Shrinking traditional fossil energy resources...

Associated environmental problems...

“The Oceans are the Future of the Blue Planet”

Climate Change... Shrinking traditional fossil energy resources...

Associated environmental problems...

“The Oceans are the Future of the Blue Planet”



Marine Renewables!

INTRODUCTION IN CHAIR'S RESEARCH GROUP

❑ **Led by Prof. Peter TROCH**

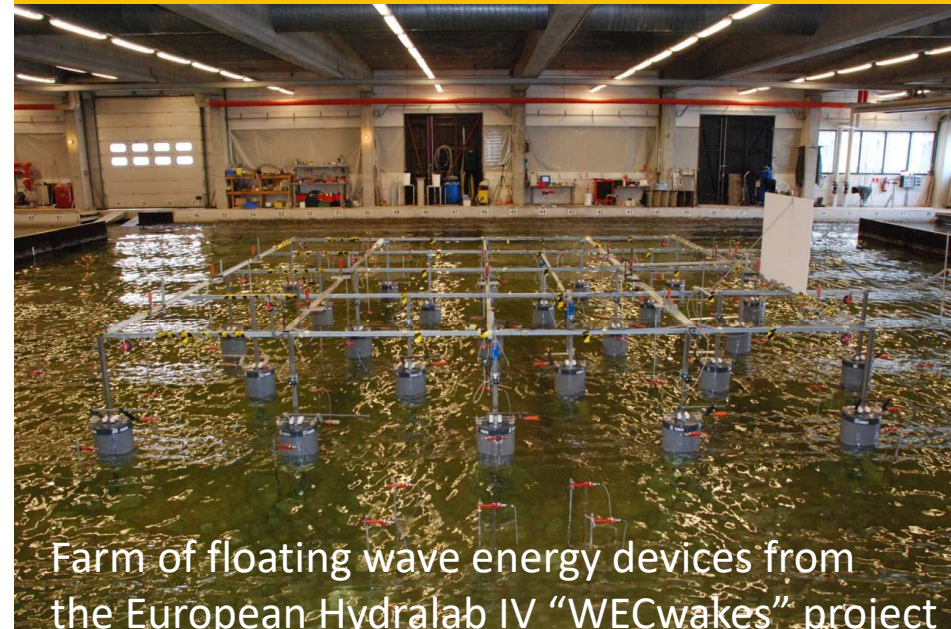
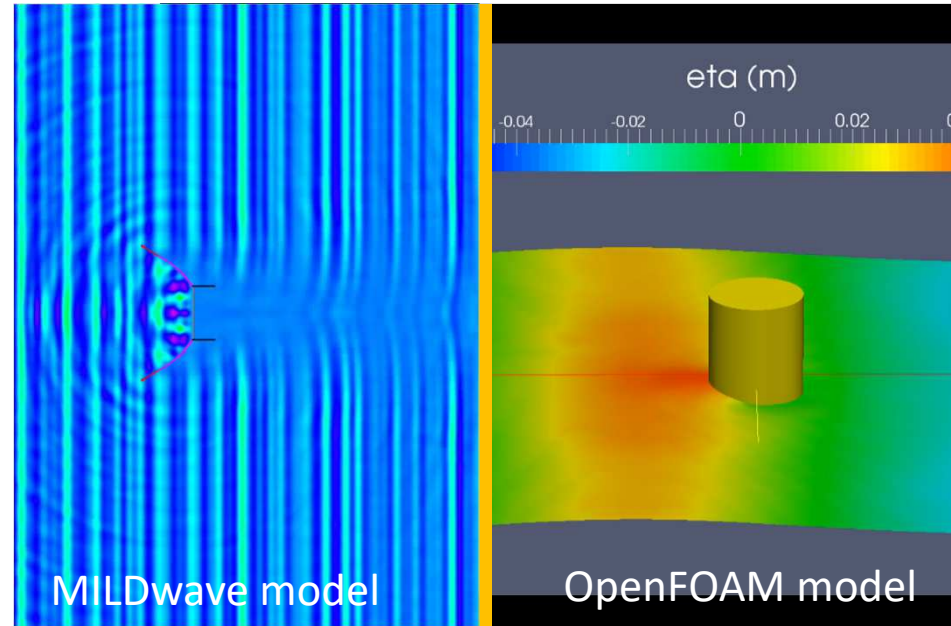
Coastal Engineering Research Group,
Ghent University, Belgium

❑ **Expertise**

- Coastal & Offshore structures
- Harbour design
- Marine Renewable Energy (MRE)

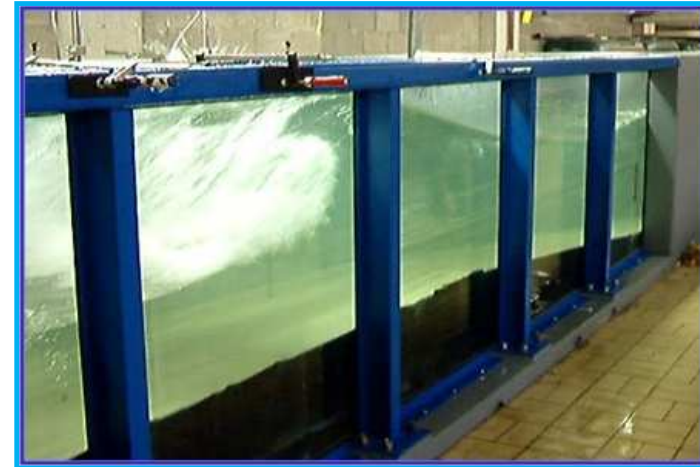
❑ **Research tools:**

- numerical modelling
 - Suite of models for MRE
- physical modelling
 - Wave flumes & wave basin



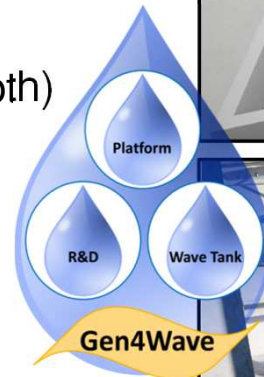
WAVE FLUMES

- Large Wave & Current Flume
 - 30m x 1.0m x 1.2m (LxWxH)
 - $H_{\max} = 0.35$ m
 - Piston-type
- Small Wave Flume
 - 15m x 0.35m x 0.6m (LxWxH)
 - $H_{\max} = 0.20$ m
 - Piston-type

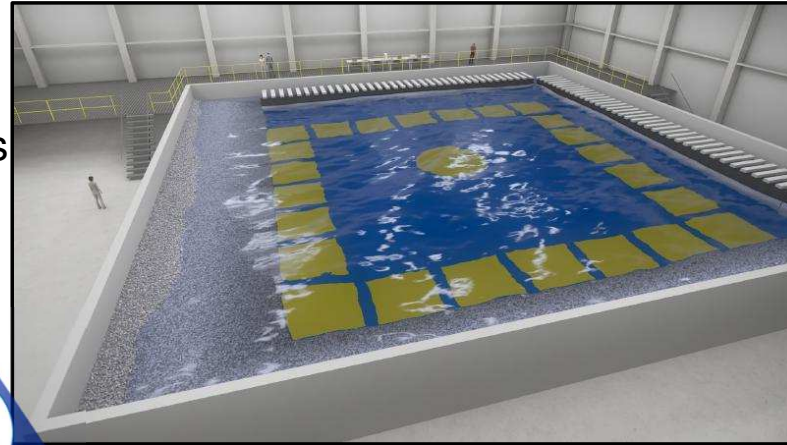


COASTAL & OCEAN WAVE BASIN

- **COB profile** (<http://COB.ugent.be>)
 - wave tank for wave, current & wind loads
 - in any relative direction
 - Coastal and offshore structures
 - Ocean energy technologies
 - Dimensions: 30x30x1.4 m
 - Deep central pit (4m water depth)



- Funding from HERCULES foundation and the Flemish Government.
- consortium UGent, KU Leuven, Flanders Hydraulics Research.



GHENT
UNIVERSITY

Reference: Troch P, Stratigaki V, Devriese P, et al. Design features of the upcoming Coastal and Ocean Basin in Ostend, Belgium, for Offshore, Coastal and Marine Renewable Energy applications.

Proceedings of the 12th EWTEC-2017. p. 1155–64.

THE OCEANS ARE FULL OF ENERGY!

THE OCEANS ARE FULL OF ENERGY!

Potential tidal energy

Osmotic energy

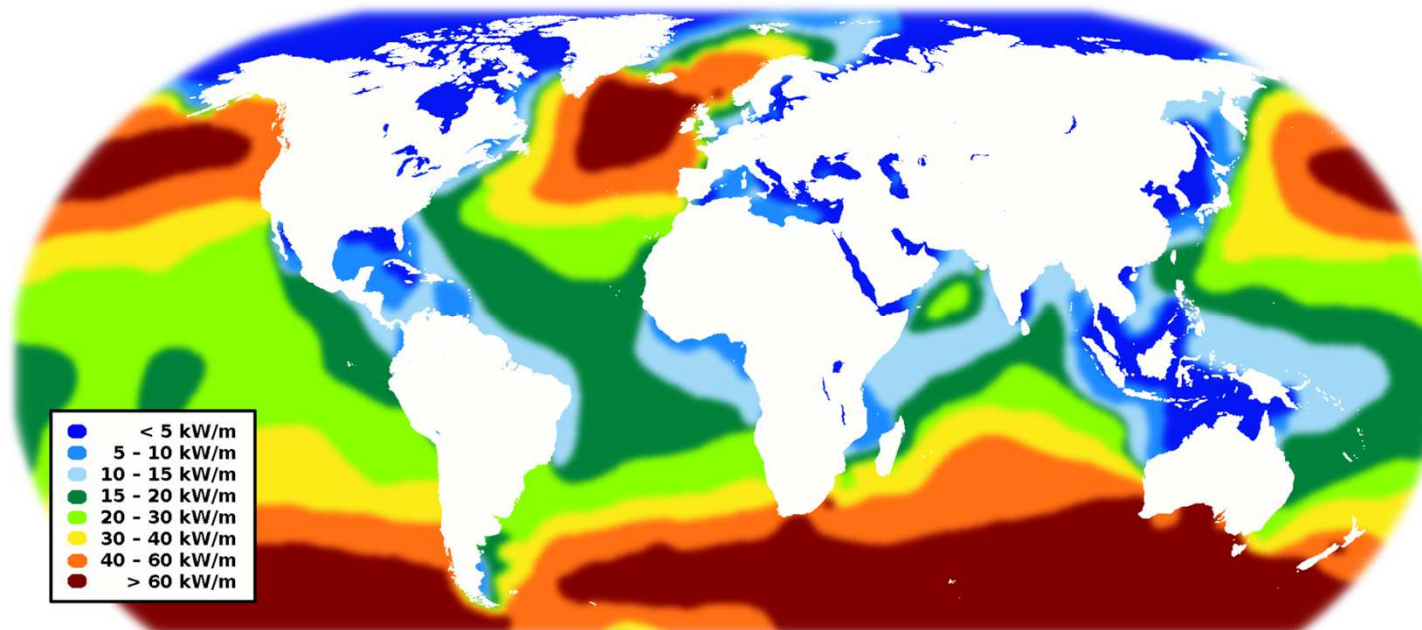
Wave energy

Thermal energy

Kinetic tidal energy

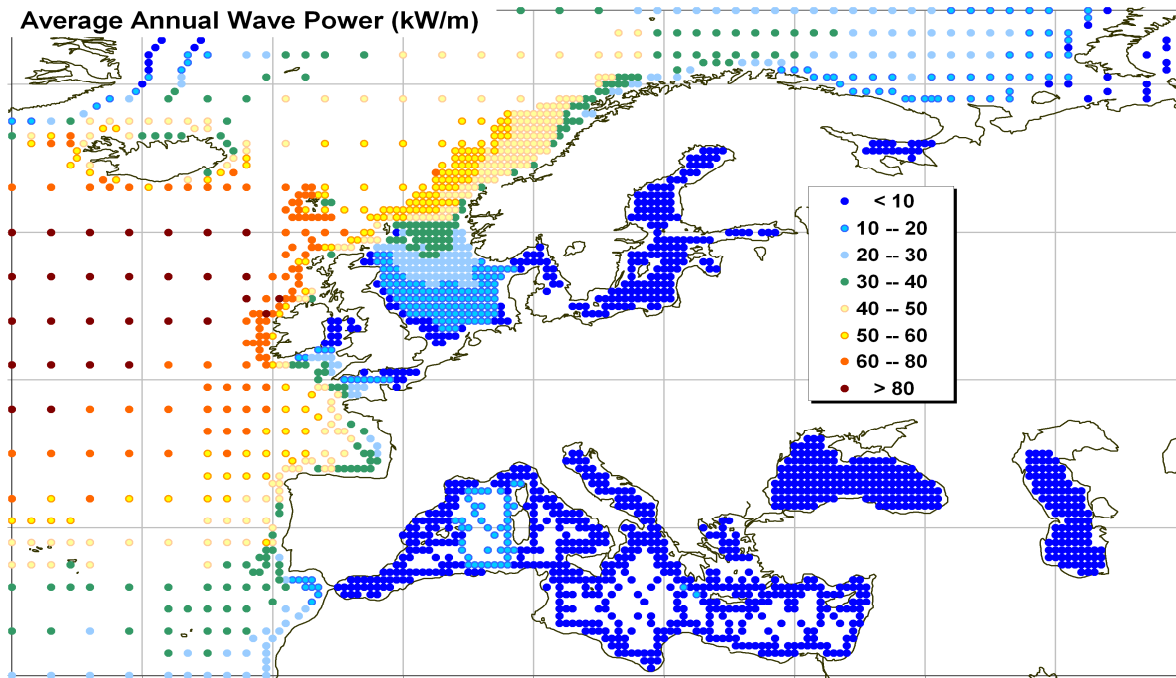


AVAILABLE WAVE POWER – WORLDWIDE



- world wide about 3 TW wave power reaches the coasts
- theoretically sufficient to provide the world wide electricity consumption
- mostly concentrated between 50° and 70° latitude

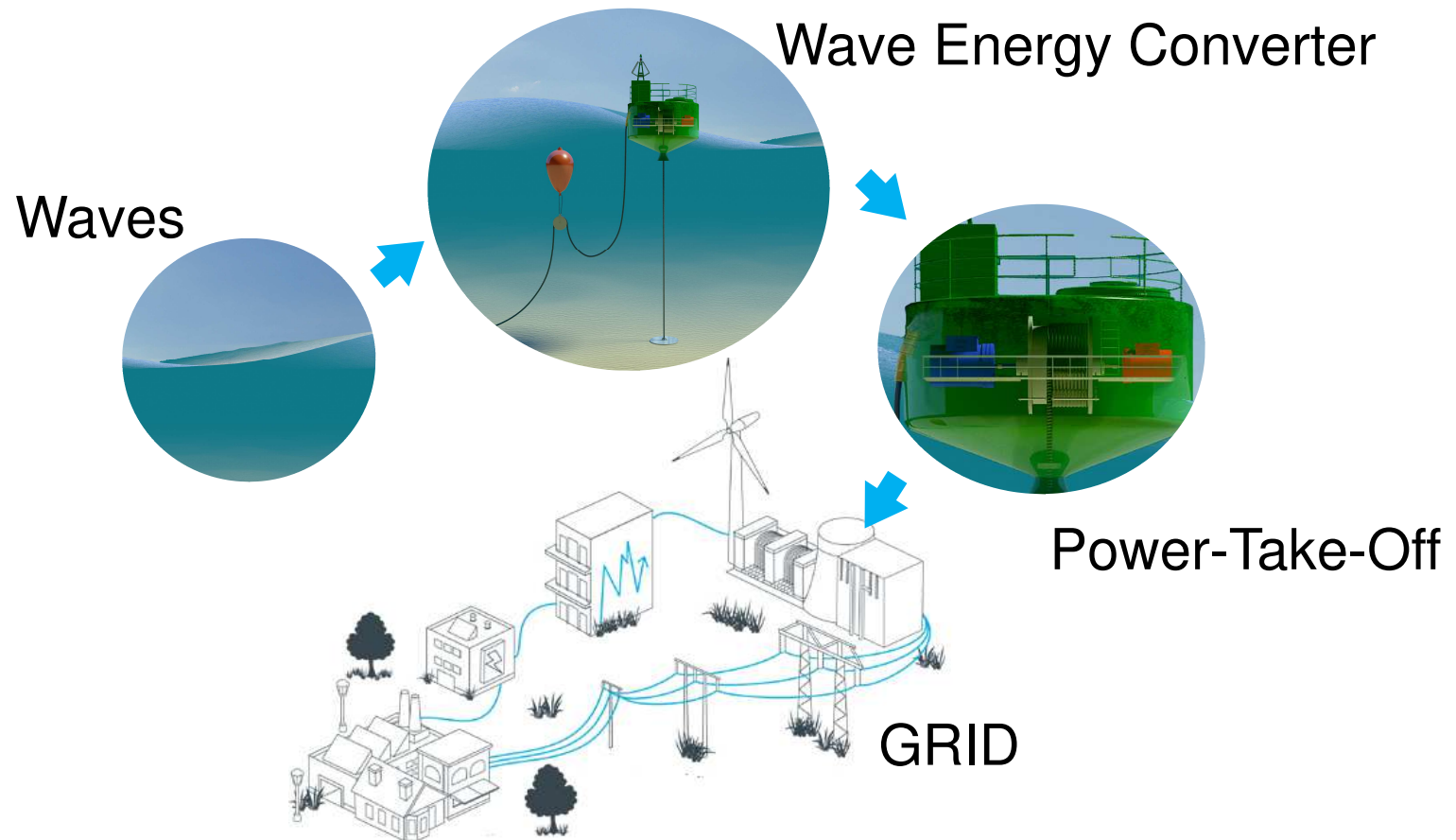
AVAILABLE WAVE POWER - EUROPE



- wave energy mainly situated near the Atlantic: Portugal, Spain, Ireland, Schotland, Iceland
- North Sea: mild wave climate, sheltered by presence of UK

WAVE ENERGY CONVERTERS

WAVE ENERGY CONVERSION



A SHORT HISTORICAL NOTE

349.
12 juillet 1799.
BREVET D'INVENTION DE QUINZE ANS,
Pour divers moyens d'employer les vagues de la mer,
comme moteurs,
Aux sieurs GIRARD père et fils, de Paris.

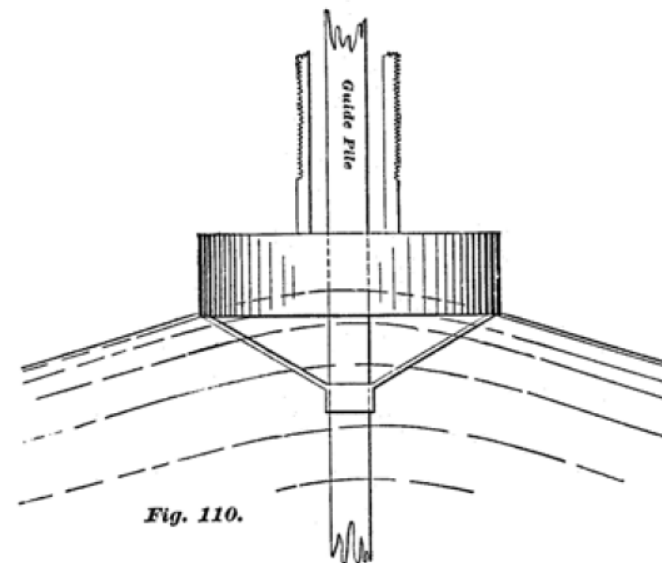
La mobilité et l'inégalité successive des vagues, après s'être élevées comme des montagnes, s'affaissent l'instant après, entraînant dans leurs mouvemens tous les corps qui surnagent, quels que soient leur poids et leur volume. La masse énorme d'un vaisseau de ligne, qu'aucune puissance connue ne serait capable de soulever, obéit cependant au moindre mouvement de l'onde. Qu'on suppose un instant, par la pensée, ce vaisseau suspendu à l'extrémité d'un levier, et l'on concevra l'idée de la plus puissante machine qui ait jamais existé.

C'est principalement sur ce mouvement d'ascension et d'abaissement des vagues, qu'est fondée la théorie des nouvelles machines que nous proposons.

L'application en est aussi simple que l'idée première. Nous avons imaginé plusieurs moyens d'utiliser cette force; mais le moins compliqué de tous consiste à adapter ou à suspendre à l'extrémité

13 *

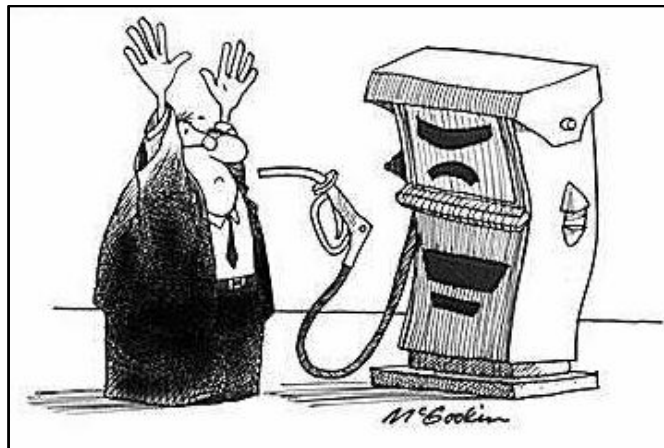
- first patent
- Girard & son (1799)
- French engineer



- wave energy converter from 1892
- definition sketch

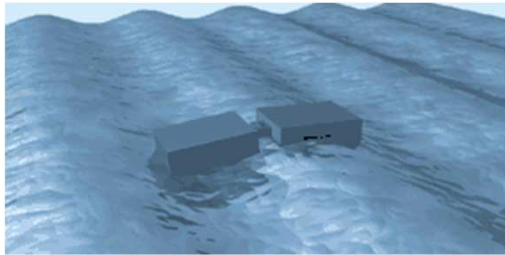
A SHORT HISTORICAL NOTE

- more recent research is very much “market driven”
 - oil crisis in the 70's
 - actual world wide energy problems

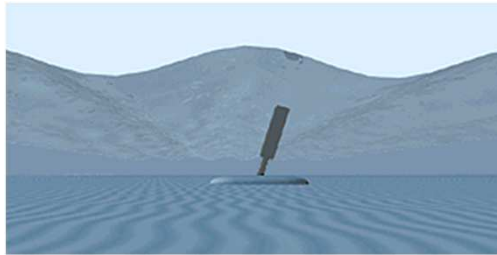


WAVE ENERGY CONVERTERS

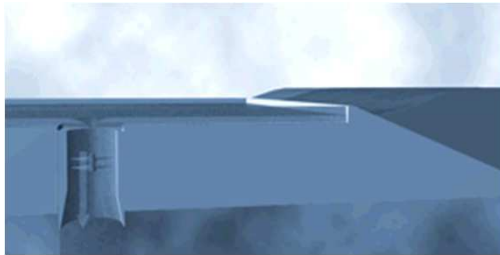
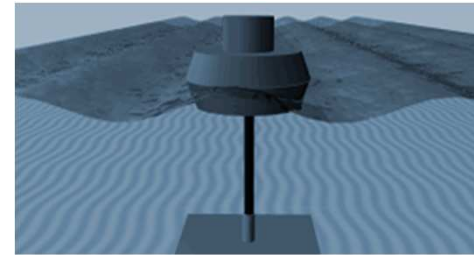
attenuator



oscillating wave surge converter



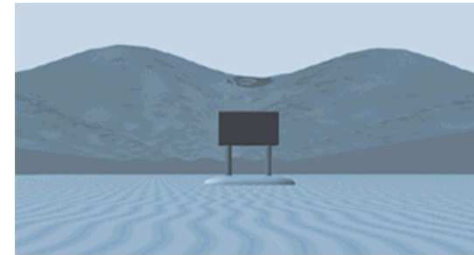
point absorbers



overtopping devices



oscillating water columns



submerged pressure differential

- 6 principal types of WECs, all in full development
- No clear winning concept, though nowadays specific types seem to appear more

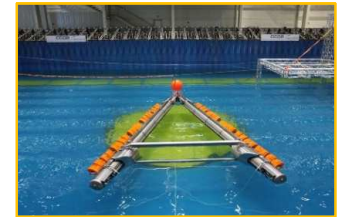
images from Aquaret2008

THE CHALLENGE OF MARINE RENEWABLES

- emerging Renewable Energy Technologies
- the sector needs
 - to **increase** the confidence of potential investors
 - by **reducing** the (non-)technological risks

WAVE ENERGY CHALLENGES

- Lots of **concepts** (inventory with about **150** concepts)
- **No uniformisation**, no choice for one type or standard solution
- **Not yet commercially** available, some pre-commercial and demo projects
- **Hybrid solutions** with wind energy technologies?
- **Risks** need to be reduced; **techno-economic** focus of research is necessary.
- **Survivability** remains a design issue
- Several notorious **failures**
- **Wave energy sector is lagging compared to tidal & offshore wind**
- **Leading countries:** UK, Denmark, Norway...



NEW PAN-EUROPEAN NETWORK

European COST Action CA17105:

“WECANet: A pan-European Network for Marine Renewable Energy with a focus on wave energy”

- Fostering **training, networking** and **collaboration** in Europe for wave energy

COST Actions for R&I networks:

WECANet is funded through the HORIZON2020 Framework Programme by COST (European Cooperation in Science and Technology, www.cost.eu), a funding agency for research and innovation networks.

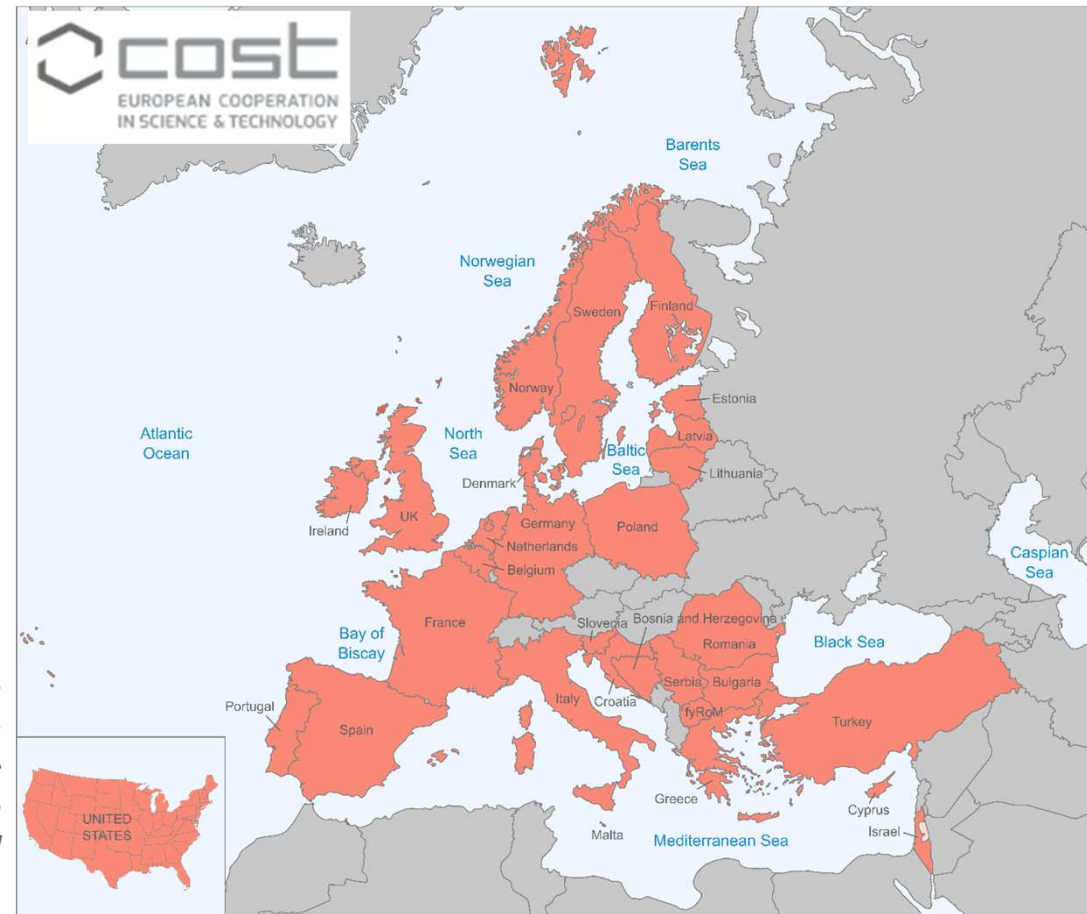
country distribution of COST Action network:

- * **30 countries**
- * network coordinated by dr. V. Stratigaki (Ghent University)

constitutional distribution of COST Action network:

- * 73% higher education
- * 13% business enterprises
- * 8% (inter-)governmental organisations
- * 5% private non-profit without market revenues, NGO

*More than 120 participants from 30 countries participate in the Action. These countries border open high-energetic oceans, and/or smaller low(er)-energetic seas. Therefore, exploitation of the available wave energy potential in Europe requires a **tailored approach, which is the target of this Action.***



NEW PAN-EUROPEAN NETWORK

European COST Action CA17105:

“WECANet: A pan-European Network for Marine Renewable Energy with a focus on wave energy”

- ▶ Excellence through a collaborative and inclusive approach (by considering Inclusiveness Target Countries, gender and geographical balance, Early Career Investigators)

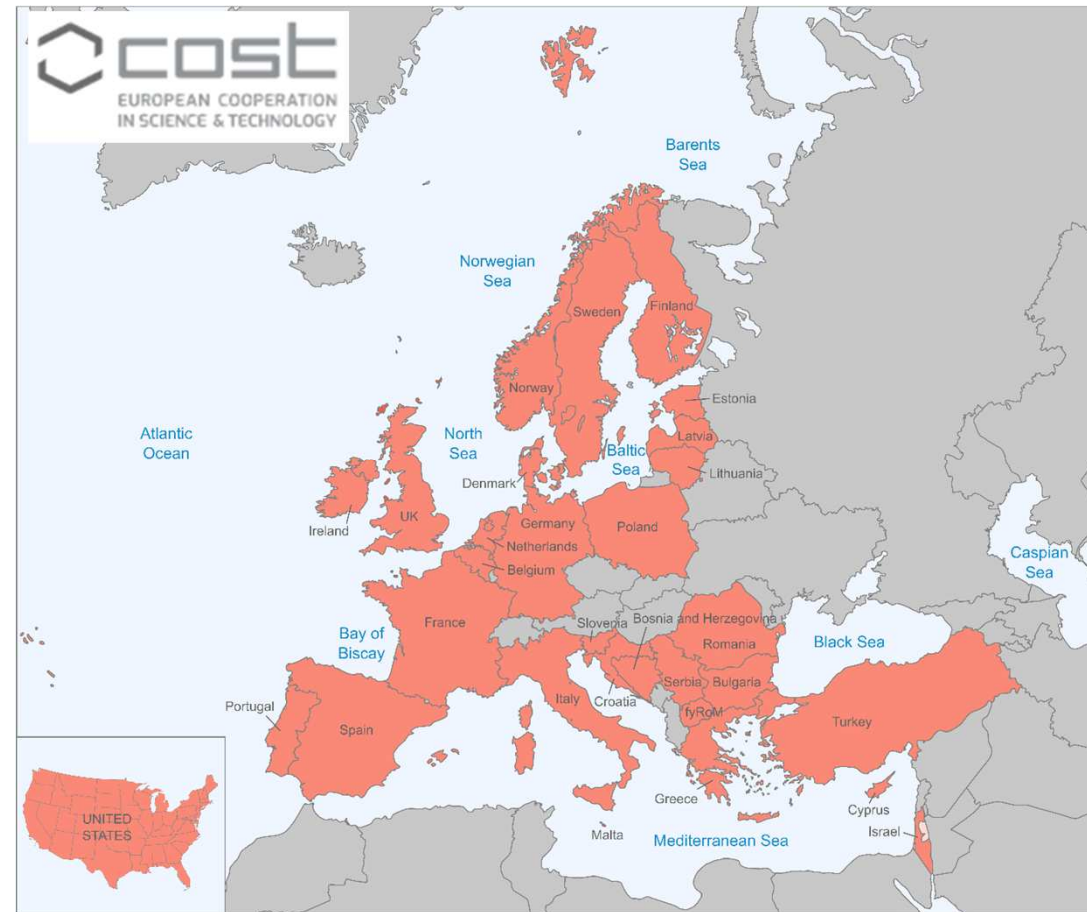
COST Policy



Additionally, specific objectives:

- SME and Industry cooperation
- International Cooperation

Excellence!



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COST Policy



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Excellence through interdisciplinary approach

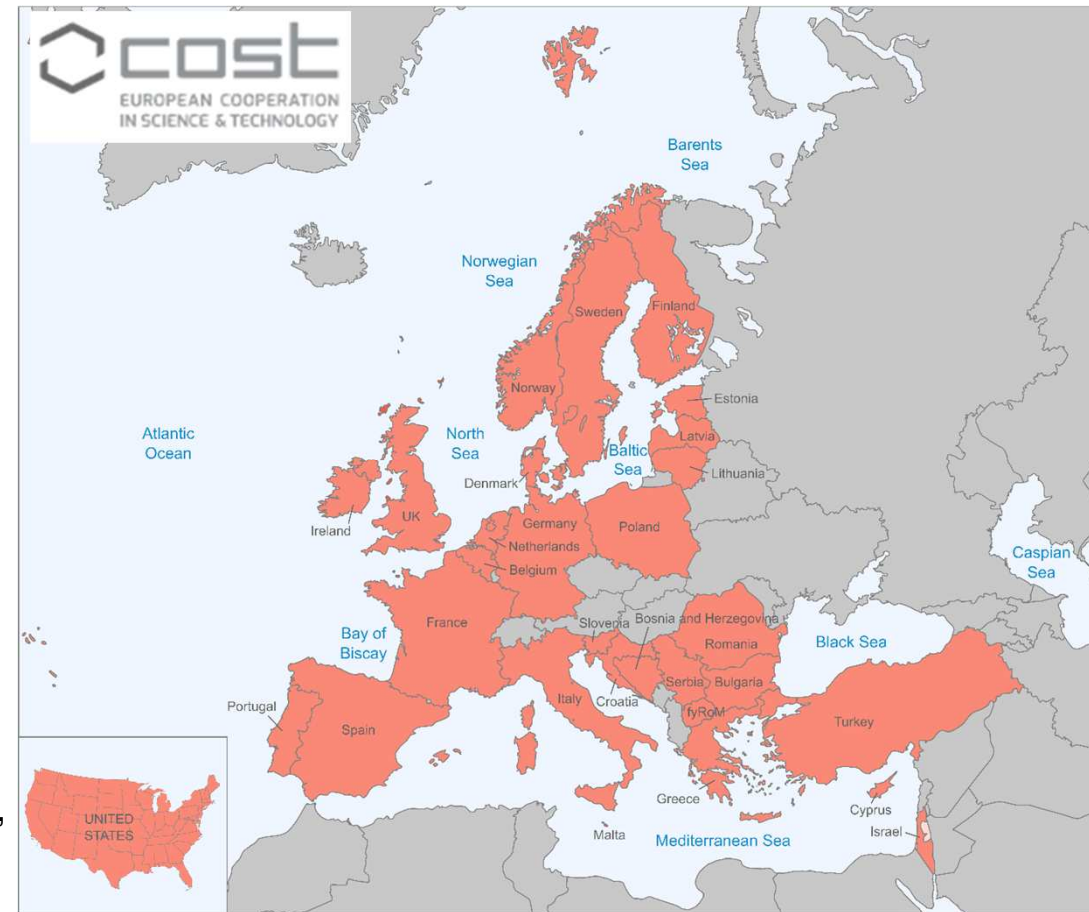
of Wave Energy Challenges by bringing together:

engineers dealing with all technical aspects,

marine biologists, researchers, professionals,

environment, economy and legislation experts,

policy makers, industry, for collaboration!



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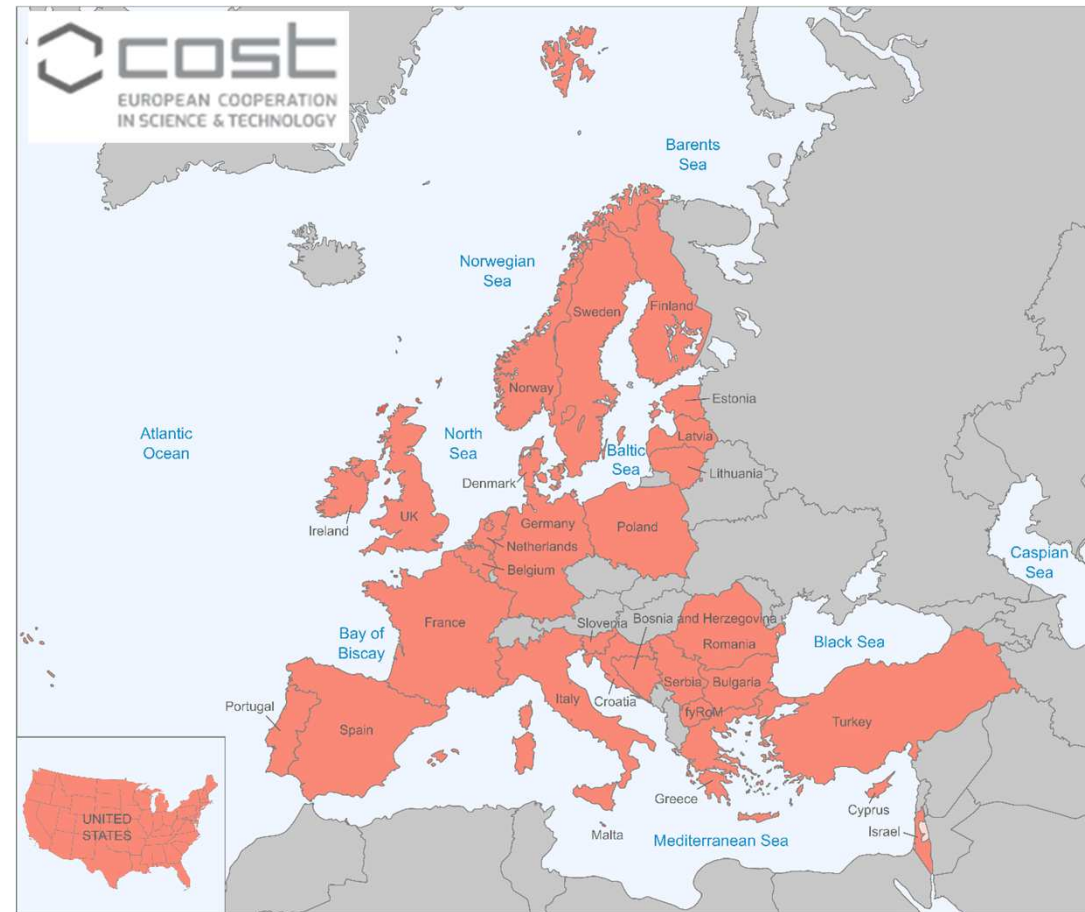


Additionally, specific objectives:

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Excellence - Knowledge through open discussion:

- Share experience and build on knowledge;
- Learn from mistakes and failures from the past in the wave energy sector;
- Active participation – not merely networking.



NEW PAN-EUROPEAN NETWORK

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- Aims at a collaborative and inclusive approach (through considering Inclusiveness Target Countries, gender and geographical balance, Early Career Investigators)

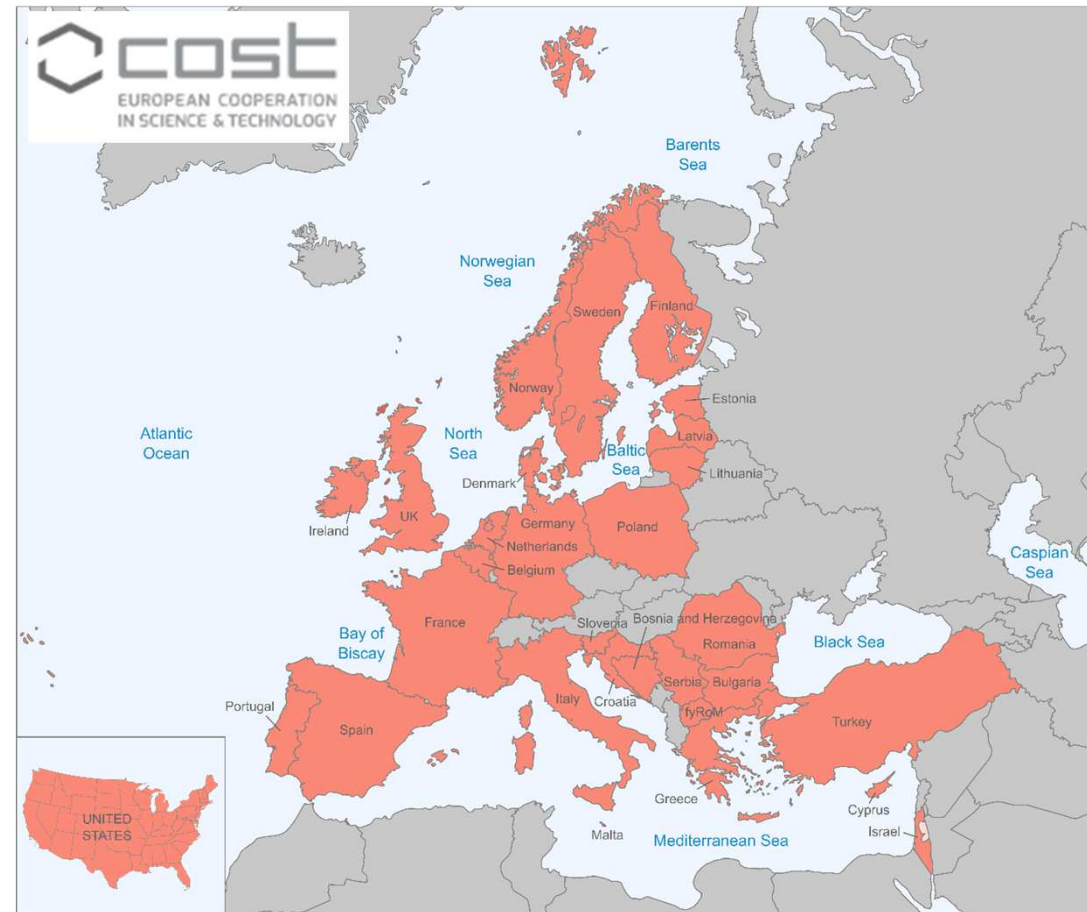
COST Policy



Additionally, specific objectives:

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Inclusiveness!



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COST Policy

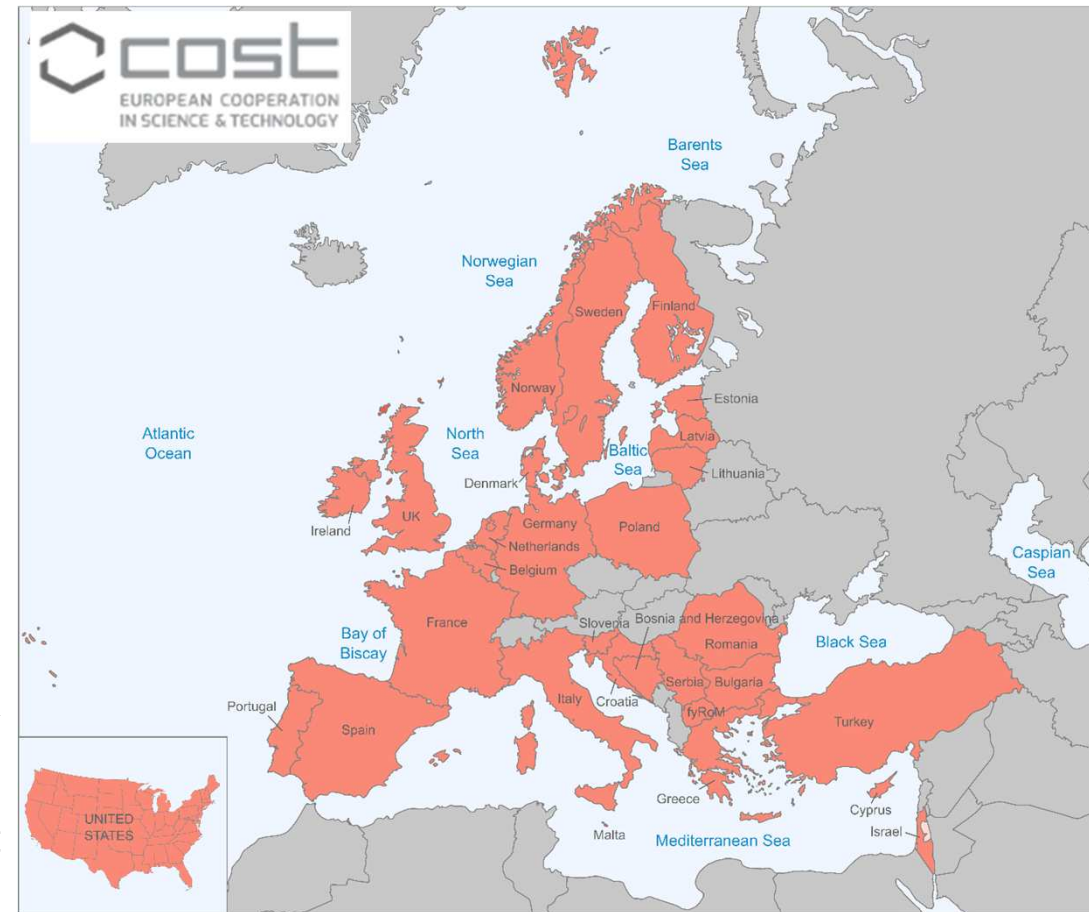


Additionally, specific objectives:

- SME and Industry cooperation
- International Cooperation

Unique geographical coverage!

WECANet has participants from Croatia, Greece, Romania, Slovenia, Turkey, fYRoM, Bosnia & Herzegovina, Poland, Serbia, Lithuania, Latvia, Estonia, Finland, Bulgaria, Malta, Cyprus; countries which have interest in MRE but may not have a long MRE R&D&I tradition.



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COST Policy

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- International Cooperation



Achieving inclusiveness from a gender balance point of view

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COST Policy



Additionally, specific objectives:

- SME and Industry cooperation
- International Cooperation

Achieving inclusiveness from a gender aspect
Gender distribution within WECANet: 1/3 of the participants are women.



NEW PAN-EUROPEAN NETWORK

European COST Action CA17105:

“WECANet: A pan-European Network for Marine Renew

- Aims at a collaborative and inclusive approach (through geographical balance, Early Career Investigators)

COST Policy



Additionally, specific objectives:

- SME and Industry cooperation
- International Cooperation

Achieving inclusiveness by including researchers and professionals of all backgrounds and ages:

ideal recipe for creating best conditions for active participation and for knowledge transfer.



WECANET WORKING GROUPS

WG1 – Numerical hydrodynamic modelling for WECs, WEC arrays/farms and wave energy resources

(accuracy, uncertainty, coupling, applicability, usability)

WG2 – Experimental hydrodynamic modelling and testing of WECs, WEC arrays/farms, PTO systems, and field data

(accuracy, uncertainty, testing facility suitability, measurement techniques)

WG3 – Technology of WECs and WEC farms

WG4 – Impacts and economics of wave energy and how they affect decision- and policy-making

COD – COST Action COordination and Dissemination

WHO ARE WE? – WECANET CORE GROUP

Action Leadership Positions

Action Chair	Dr Vicky STRATIGAKI ▼
Action Vice Chair	Dr Matt FOLLEY ▼
WG 5 - COD – COST Action COordination and Dissemination	Prof Peter TROCH ▼
WG 1 - Numerical hydrodynamic modelling for WECs, WEC arrays/farms and wave energy resources	Prof Moncho GOMEZ GESTEIRA ▼
WG 2 - Experimental hydrodynamic modelling and testing of WECs, WEC arrays/farms, PTO systems	Dr Francesco FERRI ▼
WG 3 - Technology of WECs and WEC arrays/farms	Dr Irina TEMIZ ▼
WG 4 - Wave energy impacts and economics and how they affect decision- and policy-making	Dr George LAVIDAS ▼
Grant Holder Scientific Representative	Prof Evangelia LOUKOGEORGAKI ▼
Science Communication Manager	Prof Peter TROCH ▼
STSM Coordinator	Prof Liliana RUSU ▼

WHO ARE WE? – WECANET MC

Country	MC Member				
				North Macedonia	Prof Snezana CUNDEVA ▼
Belgium	Ms Tina MERTENS ▼	Germany	Dr Hisham ELSAFTI ▼	Norway	Dr Hans Christian BOLSTAD ▼
Belgium	Prof Peter TROCH ▼	Germany	Mr Jochen BARD ▼	Norway	Dr Lars GOLMEN ▼
Bosnia and Herzegovina	Mr Jovan TODOROVIC ▼	Greece	Prof Evangelia LOUKOGEORGAKI ▼	Poland	Dr Małgorzata ROBAKIEWICZ ▼
Bulgaria	Dr Daniela DZHONOVA-ATANASOVA ▼	Greece	Prof Kostas BELIBASSAKIS ▼	Poland	Prof Leszek CHYBOWSKI ▼
Bulgaria	Dr Valeri PENCHEV ▼	Ireland	Dr James MURPHY ▼	Portugal	Prof Carlos GUEDES SOARES ▼
Croatia	Prof Damir ŠLJIVAC ▼	Ireland	Prof John RINGWOOD ▼	Portugal	Prof Francisco TAVEIRA-PINTO ▼
Croatia	Prof Marinko STOJKOV ▼	Israel	Prof Michelle PORTMAN ▼	Romania	Prof Liliana RUSU ▼
Cyprus	Dr Constantine MICHAILIDES ▼	Italy	Prof Barbara ZANUTTIGH ▼	Romania	Prof Lorand SZABO ▼
Cyprus	Ms Xenia LOIZIDOU ▼	Italy	Prof Lorenzo CAPPIETTI ▼	Serbia	Dr Nikola MOMCILOVIC ▼
Denmark	Dr Björn ELSÄSSER ▼	Latvia	Dr Ilze PRIEDITE ▼	Serbia	Prof Branka NAKOMČIĆ-SMARAGDAKIS ▼
Denmark	Dr Francesco FERRI ▼	Latvia	Dr Juris BURLAKOVŠ ▼	Slovenia	Prof Aleksander GRM ▼
Estonia	Dr Ira DIDENKULOVA ▼	Lithuania	Dr Darius JAKIMAVIČIUS ▼	Spain	Prof Izaskun GARRIDO ▼
Estonia	Dr Rivo UIBOUPIN ▼	Lithuania	Dr Loreta KELPŠAITĖ-RIMKIENĖ ▼	Spain	Prof Moncho GOMEZ GESTEIRA ▼
Finland	Mr Heikki KOIVISTO ▼	Malta	Dr Cedric CARUANA ▼	Sweden	Dr Irina TEMIZ ▼
France	Dr Paolino TONA ▼	Malta	Mr Mario CACHIA ▼	Turkey	Dr Dogan KISACIK ▼
France	Prof Michel BENDIT ▼	Netherlands	Dr George LAVIDAS ▼	Turkey	Dr Gülizar ÖZYURT TARAKCIOĞLU ▼
		Netherlands	Dr Henk POLINDER ▼	United Kingdom	Dr Helen SMITH ▼
				United Kingdom	Dr Matt FOLLEY ▼

HIGHLIGHTS OF WECANET'S ACTIVITIES WITHIN ITS FIRST HALF YEAR



Numerical and
Experimental
Modelling of Wave
Field Variations
around Arrays of
Wave Energy
Converters

Guest Editors

Prof. Dr. Peter TROCH
Dr. Vicky STRATIGAKI
Dr. Matt FOLLEY
Assist. Prof. Dr. Eva
LOUKOGEORGAKI

Deadline

31 October 2019

Special Issue

Invitation to submit

WECANet provided funding for:

- **Short Term Scientific Missions: researchers' mobility; scientific collaborations!**
- **1st WECANet Annual Assembly held at Thessaloniki, Greece, on 11-12 February 2019** (more than 100 participants)
-- > besides working meetings, opportunity to meet and network!
- **Wave Energy Training Course held at Varna, Bulgaria, from 18 to 22 March 2019**
(6 international lecturers established in wave energy; 30 trainees from around Europe).
- **Dissemination activities and publications.**

WECANET PUBLICATIONS WITHIN THE ACTION'S FIRST HALF YEAR



- **Poster presentation and abstract**



Poster presentation

WECANet: An open pan-European Network for Marine Renewable Energy with a focus on wave energy – European COST Action CA17105

Stratigaki Vasiliki¹, Troch Peter¹, Foley Matt², Mertens Tina³, Janssen Colin⁴, Motmans Sarina⁵, Candries Maxim¹, Forehand David⁶, Loukogeorgaki Evangelia⁷, Rusu Liliana⁸, Gesteira Moncho Gomez⁹, Grm Aleksander¹⁰, Ferri Francesco¹¹, Capietti Lorenzo¹², Temiz Irina¹³, Michailides Constantine¹⁴, Lavidas George¹⁵ and Loizidou Xenia¹⁶

¹ Department of civil engineering, Faculty of engineering and architecture, Ghent University, Technologiepark 60, 9052 Zwijnaarde, Belgium
E-mail: vicky.stratigaki@ugent.be



WECANET PUBLICATIONS WITHIN THE ACTION'S FIRST HALF YEAR



- In the Annual report of the “Ocean Energy Systems” by the International Energy Agency.

RESEARCH & DEVELOPMENT

MARINERG-I

Ghent University (<http://www.ugent.be>) is strategic partner in the H2020 MARINERG-I project (www.marinerg-i.eu) coordinated by the MaREI Centre at University College of Cork Ireland, which brings together all the European countries with significant testing capabilities in offshore renewable energy. MARINERG-I is developing a plan for an Integrated European Research Infrastructure, an independent legal entity, designed to facilitate the future growth and development of the Offshore Renewable Energy sector. Ghent University is participating in MARINERG-I with marine energy technologies testing infrastructure which includes wave flumes and the new Coastal and Ocean Basin (www.cob.ugent.be).

Gen4Wave project – Coastal & Ocean Basin

The Flemish government decided to invest 5M euros in the Gen4Wave project. The Board of Directors of the Hercules Foundation approved the proposal by Ghent University and KU Leuven for research infrastructure coupled to Gen4Wave for an amount of 2.3M euros. Gen4Wave is the start of an investment project, including the construction and start-up of a wave tank, featuring waves, currents and wind loads, as test infrastructure for coastal engineering and offshore renewable energy in Flanders.

The new Coastal and Ocean Basin (COB) at the GreenBridge campus in Ostend is planned to be operational in 2019. The facility is part of the Gen4Wave project on renewable energy and coastal engineering in Flanders, Belgium, and is co-funded by the Hercules foundation and the Ministry of Mobility and Public Works.

WECANet

WECANet (www.wecanet.eu) is the new European COST Action network of 30 countries dedicated to Marine Renewable Energy, with a focus on Wave Energy. WECANet is funded through the HORIZON2020 Framework Programme by COST (European Cooperation

in Science and Technology, www.cost.eu), a funding agency for research and innovation networks. WECANet fosters transnational collaboration, the organisation of training on Marine Renewable Energy topics (International Training Courses), the realisation of the so-called “Short Term Scientific Missions” between researchers of different countries, networking events and dissemination activities. In Belgium, WECANet is coordinated by the

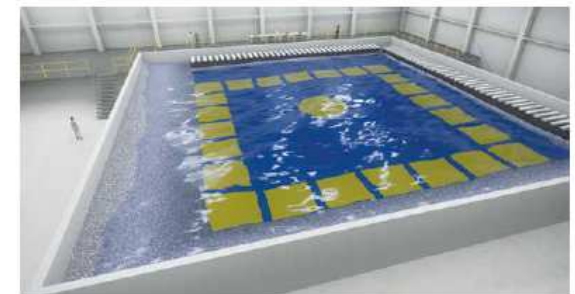


The 30 WECANet COST Action partners (in colour)

Coastal Engineering Research Group of Ghent University (UGent-CERG) and is actively supported by activities of the Flanders Marine Institute (VLIZ, <http://www.vliz.be>), the Marine@UGent cluster and the Provincial Development Agency West-Flanders (POM).

PhD research projects at Ghent University dedicated to wave energy research

The Research Foundation Flanders (FWO, <https://www.fwo.be/>) funded in 2018 six PhD research projects (two of them by the previous “IWT”), on wave energy topics, all of them carried out at the Coastal Engineering Research Group of Ghent University.




Visualisation of the new Coastal and Ocean Basin (COB) in Belgium, a testing infrastructure for Marine Renewable Energy.

WECANET PUBLICATIONS WITHIN THE ACTION'S FIRST HALF YEAR

- 1st Special Issue on WECANet topics currently open for manuscript submission:



[https://www.mdpi.com/journal/water/special issues/Wave WEC](https://www.mdpi.com/journal/water/special%20issues/Wave%20WEC)



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- Vol. 3 (2011)
- Vol. 2 (2010)
- Vol. 1 (2009)

2019 WATER TRAVEL AWARDS
WINNERS ANNOUNCED HERE





Special Issue "Numerical and Experimental Modelling of Wave Field Variations around Arrays of Wave Energy Converters"

- Print Special Issue Flyer
- Special Issue Editors
- Special Issue Information
- Keywords
- Published Papers

A special issue of *Water* (ISSN 2073-4441). This special issue belongs to the section "Hydraulics".


Deadline for manuscript submissions: 31 October 2019

Share This Special Issue




Special Issue Editors


Guest Editor
Prof. Dr. Peter TROCH
Department of Civil Engineering, Ghent University, Technologiepark 904, 9052 Ghent, Belgium
Website 1 | Website 2 | Website 3 | E-Mail
Interests: wave energy; wave–structure interaction; wave tank experiments; numerical modelling of WEC farm wake effects; moored floating structures




Guest Editor
Dr. Vicky STRATIGAKI
Department of Civil Engineering, Ghent University, Technologiepark 904, 9052 Ghent, Belgium
Website 1 | Website 2 | Website 3 | E-Mail
Interests: marine renewable energy; wave energy converter arrays; experimental modelling; numerical coupling methodologies; WEC–WEC interactions



Guest Editor
Dr. Matt FOLLEY
Marine Renewables Research Group, Queen's University Belfast, Belfast, United Kingdom
Website | E-Mail
Interests: wave energy; spectral-domain modelling; wave energy resource; wave energy arrays; wave-tank modelling



Guest Editor
Assist. Prof. Dr. Eva LOUKOGEORGAKI
Division of Hydraulics and Environmental Engineering, Department of Civil Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece
Website | E-Mail
Interests: Fluid–structure interaction; ocean engineering; moored floating structures; multi-body hydrodynamic interactions; hydroelasticity; wave energy converters; offshore wind turbine



Numerical and
Experimental
Modelling of Wave
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around Arrays of
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Special Issue
Invitation to submit

WECANet: The first open pan-European Network for Marine Renewable Energy with a focus on wave energy – COST Action CA17105

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Abstract—Growing energy demand has increased interest in marine renewable energy resources, i.e. wave energy which is harvested through Wave Energy Converter (WEC) Arrays.

However, the wave energy industry is currently at a significant juncture in its development, facing a number of challenges which require that research re-focuses on a holistic techno-economic perspective, where economics consider the full life-cycle costs of the technology. It also requires development of WECs suitable for niche markets, because in Europe there are inequalities regarding wave energy resources, wave energy companies, national programmes and investments. As a result, in Europe there are leading and non-leading countries in wave energy technology. The sector also needs to increase confidence of potential investors by reducing (non-)technological risks. This can be achieved through an interdisciplinary approach by involving engineers, economists, environmental scientists, legislation, governmental bodies and policy experts. Consequently, the wave energy sector needs to receive the necessary attention compared to other more advanced and commercial ocean energy technologies (e.g. offshore wind).

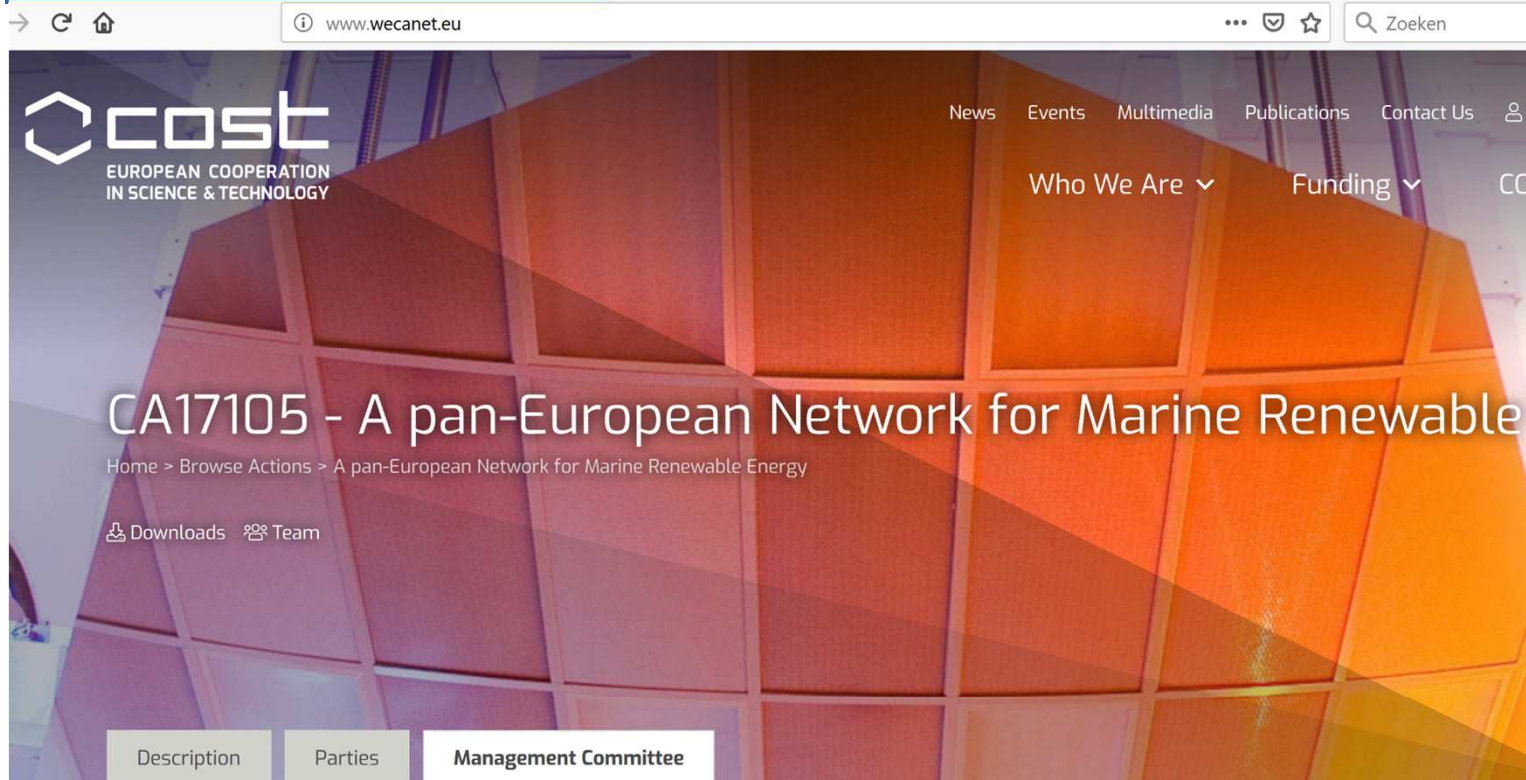
The formation of the first open pan-European Network on an interdisciplinary approach will contribute to large-scale WEC Array deployment by dealing with the current bottlenecks. The WECANet European COST Action, introduced in September 2018 and presented in this paper, aims at a collaborative and inclusive approach, as it provides a strong networking platform that also creates the space for dialogue between all stakeholders in wave energy. An important characteristic of the Action is that participation is open to all parties interested and active in the development of wave energy. Previous activities organised by WECANet core group members have resulted in a number of joint European projects and scientific publications. WECANet's main target is the equal research, training, networking, collaboration and funding opportunities for all researchers and professionals, regardless of age, gender and country in order to obtain understanding in the main challenges governing the development of the wave energy sector.

Keywords—Marine Renewable Energy Network, Wave energy, Ocean energy, Wave Energy Converters, WECANet, European COST Action, CA17105.



Oral presentation & paper in the proceedings

WECANET: AN OPEN PAN-EUROPEAN NETWORK FOR MARINE RENEWABLE ENERGY



The screenshot shows the WECANET website with the URL www.wecanet.eu in the browser address bar. The page features the COST logo (European Cooperation in Science & Technology) and a navigation menu with links for News, Events, Multimedia, Publications, Contact Us, and Who We Are. The main heading is "CA17105 - A pan-European Network for Marine Renewable Energy". Below this, there are links for Downloads and Team. At the bottom, there are tabs for Description, Parties, and Management Committee, with the Management Committee tab currently selected.

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📍 Ghent, Belgium

🌐 wecanet.eu

📅 Joined February 2019

🕒 Born January 24, 1968

Thank you for your
attention!

