Reflection on Waveplam and its objectives:

are we moving towards a wave energy market

WaveEnergy Centre
Centro de Energia das Ondas

Frank Neumann, Associate Director WavEC

Waveplam

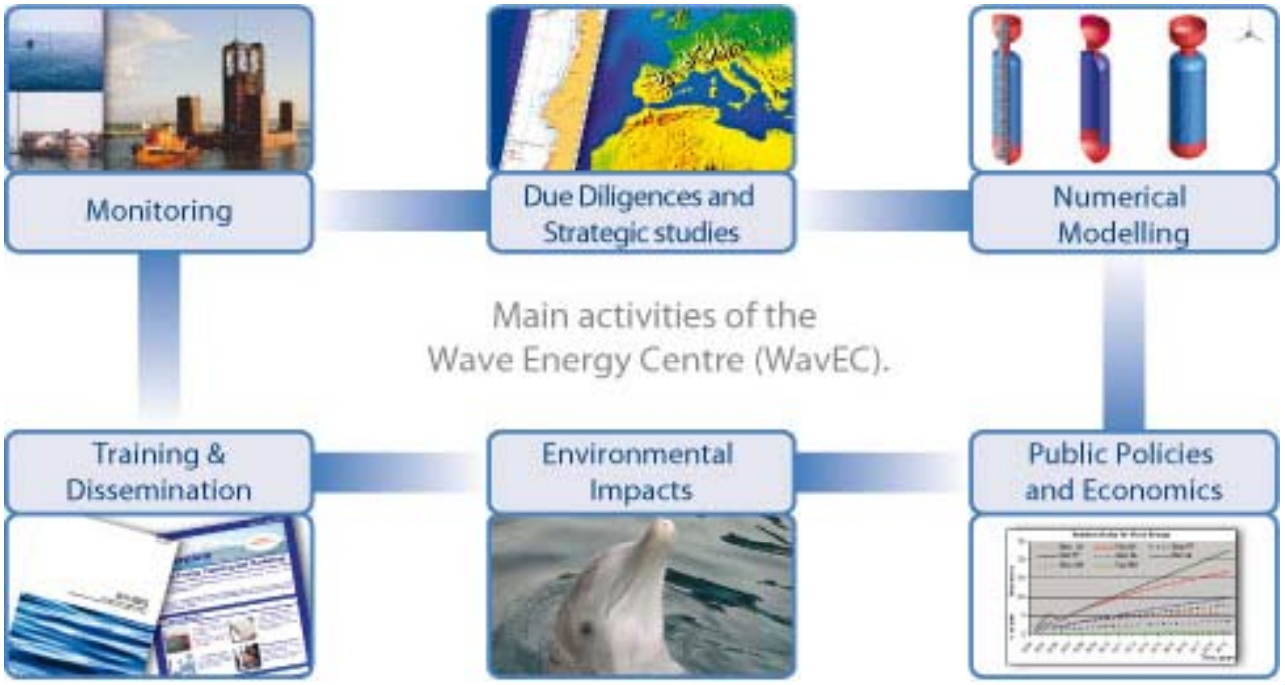
Intelligent Energy Europe

Background (beyond Waveplam)

WaveEnergy Centre
Centro de Energia das Ondas

The Wave Energy Centre

A not-for-profit association in Portugal



Industrial involvement sought... since ~year 2000 increased industrial interest

Founded 2003 without detailed mission statement

No direct public financing (only competitive calls)

100% private, quasi-self-sustaining

➔ ***Chasing*** **a market for >7 years: "in business where there is no business"**

Real scale monitoring - experience

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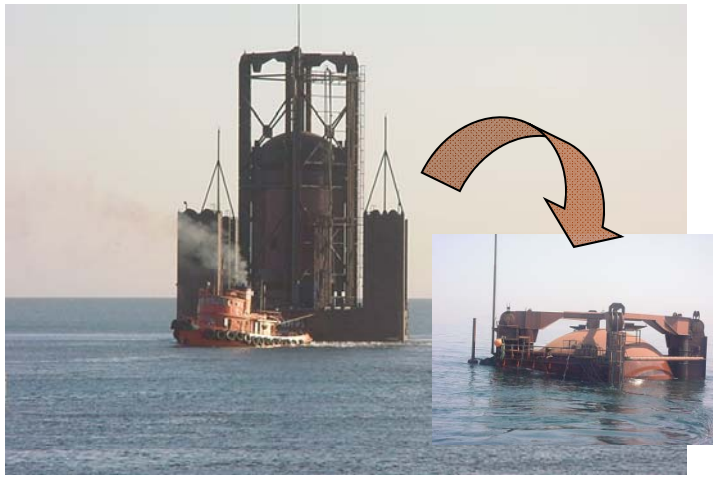
7/2004 a 11/2004

“2 MW” AWS prototype, offshore Portugal

Wave Energy Centre involvement:

- **Monitoring and evaluation of device performance**



2004 – 2006...

400 kW pilot plant, Azores, Pico island

Wave Energy Centre involvement:

- **Submission and coordination of a project financed by the Portuguese DEMTEC/PRIME program to refurbish the plant** with support of EDP, EDA, EFACEC, Kymaner, IST, Irmãos Cavaco and INETI
- **Monitoring and evaluation of device performance**

Since 2007

Real-sea monitoring as strategic priority

- **Marginal participation in public-funded part of 3-Pelamis-farm**
- **FP7-TREN: SURGE & Waveport projects: monitoring of prototypes**

+ insight into other projects

Wave energy in 2010... where are we? (1/2)

TECHNOLOGY

→ Developers to follow a logic path of development; Technology Readiness Level approach ... Equimar protocol

→ Funding schemes must be made available to match industry needs / right place&time

REGULATORY ISUES

→ Right instruments to aid permitting procedures; avoid unclear competences (easiness of licensing = industry boost = confidence of investors; one-stop-shop ?)

→ Matching of monetary support through suitable and attractive incentives in phases

→ Authorities should set ambitious-but-not-too-much targets AND have a clear strategy to achieve them, (regulatory support, funding programmes, RTD,…)

FINANCIAL

→ Capital grants best way to overcome 'valley of death'

→ Feed-in Tariffs and ROCs at slightly later stages. (+ ROCs help meet RE targets)

→ RE cost miscalculated by disregard to externalities from traditional sectors

Wave energy in 2010... where are we? (2/2)

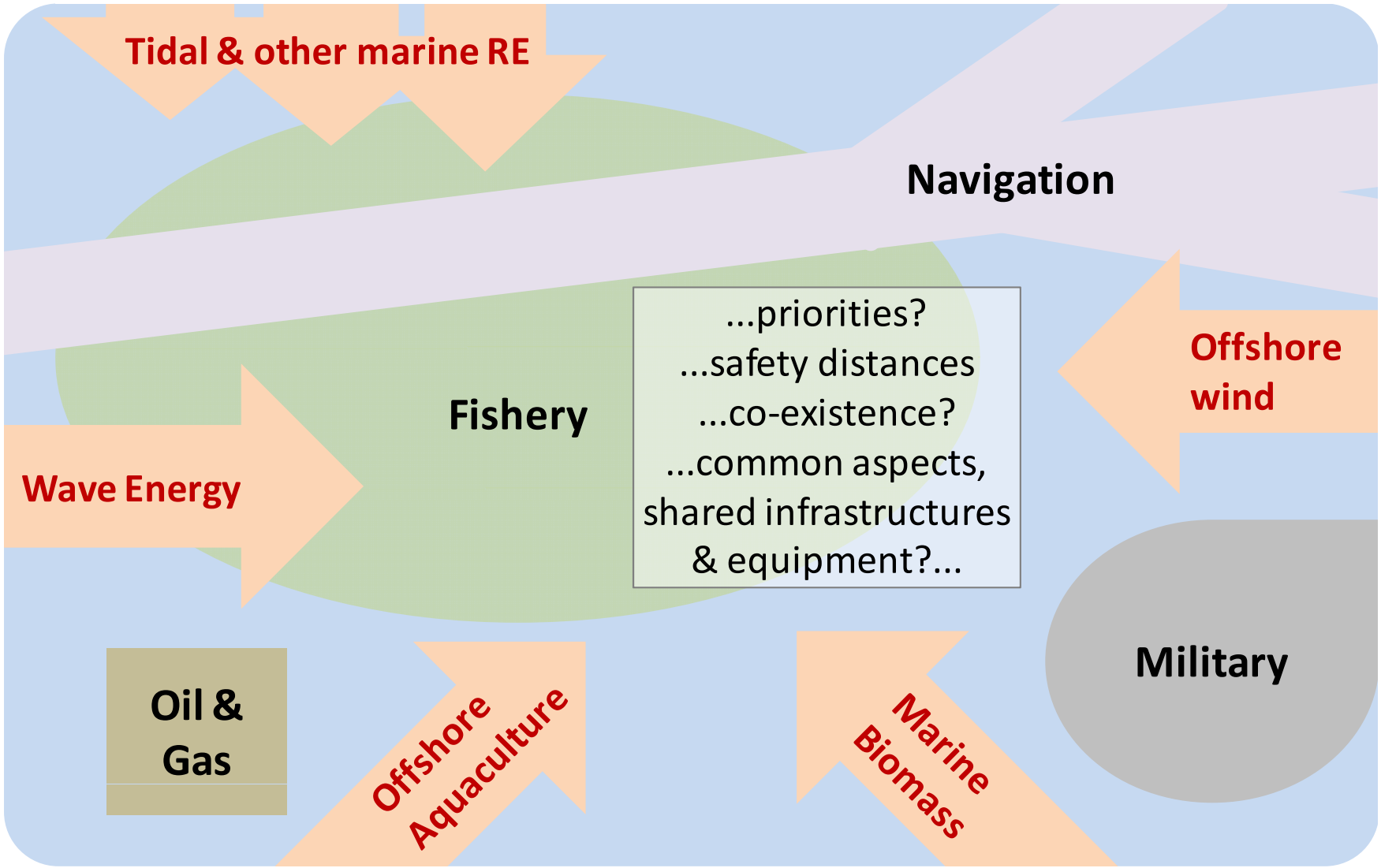
INFRASTRUCTURE / LOGISTICS

- → Adapt existing grids to new electricity market (decentralised production); necessary upgrades should be planned in time and in international cooperation
- → Cost uncertainties about upgrading, connection points granting, etc
- → Sector needs to trigger new industrial activities to ensure supply chain

ENVIRONMENTAL / PERMITTING

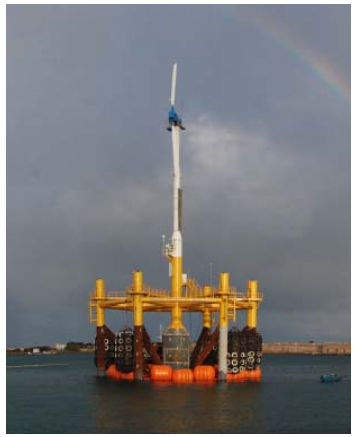
- → At present even test plants have to carry out full EIA (costly &time consuming); deployment of initial prototypes and demonstration projects should be facilitated
- → Lack of field data to support environmental analysis with factual information (need for publically available information about environmental impacts)
- → Marine Spatial Planning process to avoid conflicts of use with other sectors and in minimising environmental impact problems, introduction of environmental criteria
- → Administrations can substantially help by lowering environmental requirements for test sites and offering funding for baseline assessment studies.

...worth a thought (1/4): joint ocean space use



...worth a thought (2/4): technical synergies

- **Floating offshore wind (FOW) has been undergoing considerable advances**
- **Offshore wind as "bigger brother" of wave energy development?**
- **Preliminary studies indicate large synergy potential**



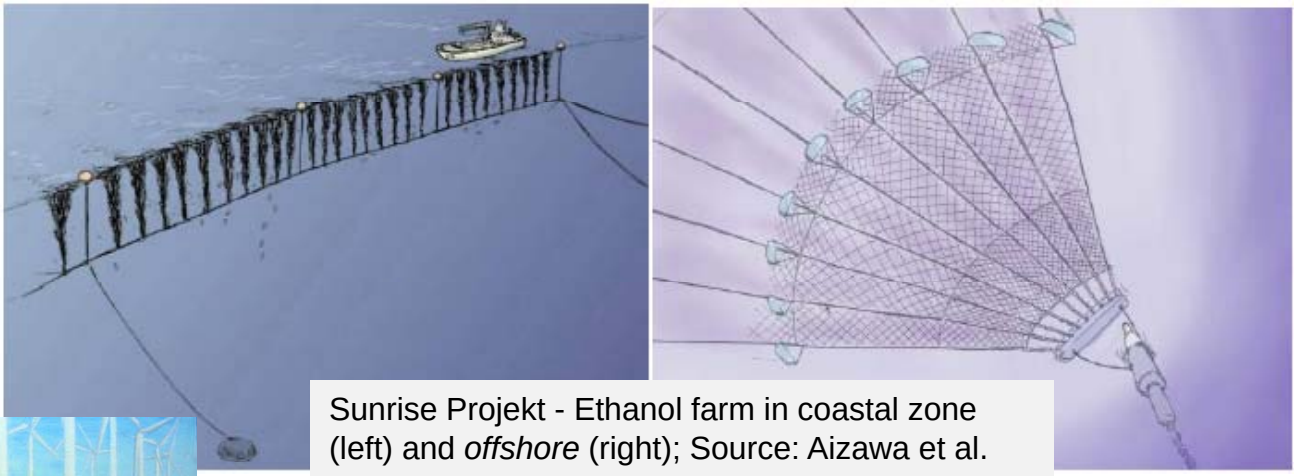
Wectop
Blue H (NL)

Hywind
Statoil Hydro (NO)

WindFloat
Principle Power
(USA)

...worth a thought (3/4): Secondary (?) uses

- Algae- Bio-Ethanol
- Pigments, Pharma
- Diet and animal food
- Fertilisers
- Large-scale CO_2-bonding through algae



Sunrise Projekt - Ethanol farm in coastal zone (left) and *offshore* (right); Source: Aizawa et al.

Multifunctional Navigation Zone; **Quelle: AWI (Buck et. al.)**

→ **Could be further offshore than RE**

→ **In case of overlapping: synergies (common moorings; Control; Operation & maintenance) *... left***

→ **Possible secondary use of wave energy arrays as marine bimoass farm**

→ **Wave energy as generator for marine biomass farms** (e.g.: C-Questor Group)

...worth a thought (4/4): Secondary (?) uses

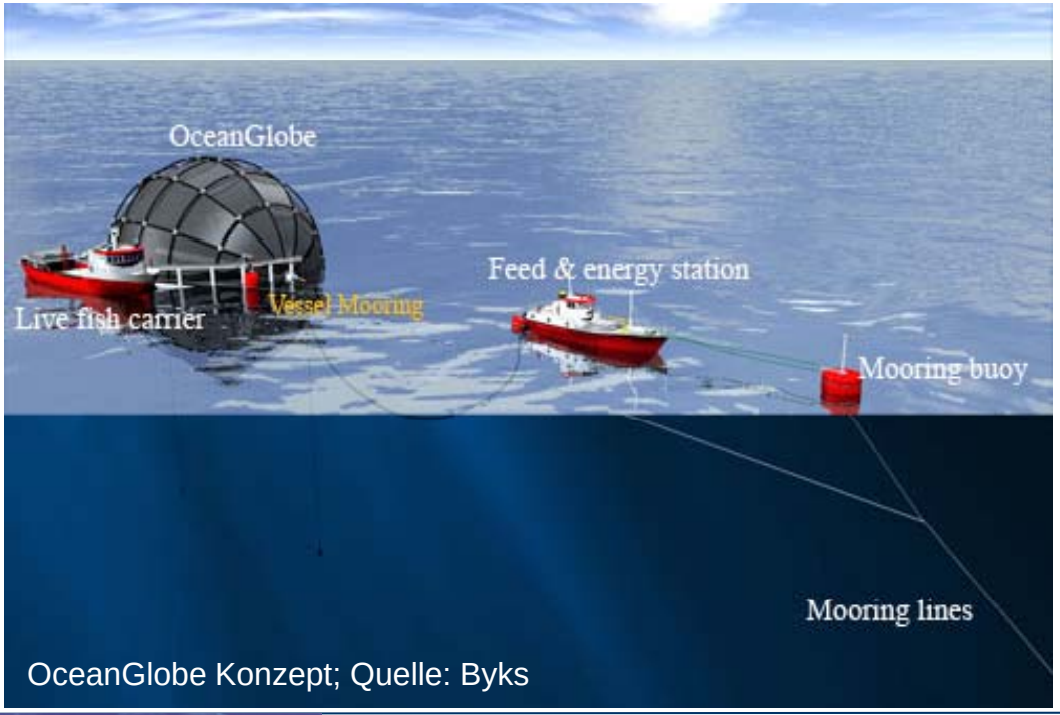
- Large-scale offshore aquaculture gains increasing attention (demand >> offer, as industrial fishing yields its physical limits; Basin cultures expensive)

HOARP Demo Projekt
Quelle: NOAA

- Water circulation and quality, Health and environemntal issues drastically reduced
- Vision for decades; success only recently

→ **Credible commercial approaches for Offshore cages (e.g. OceanGlobe /Byks; Aquapod/ Oceanfarmtech; SeaStation/OceanSpar;…)**

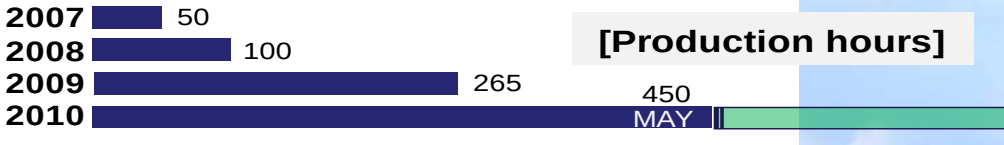
→ **Cage with propulsion (e.g.: Ocean Drifter) could be driven by wave energy… ?!**

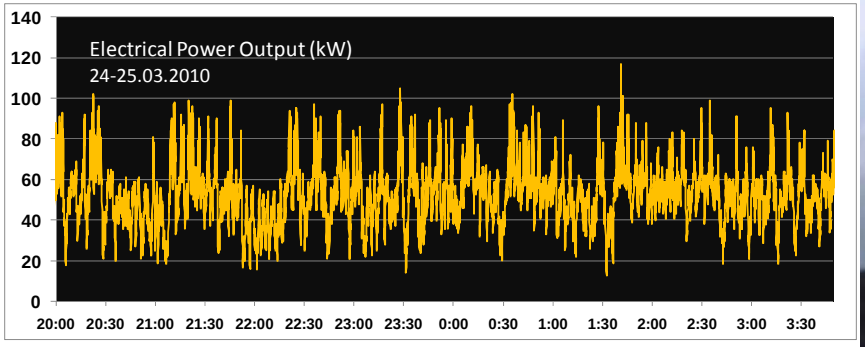


OceanGlobe Konzept; Quelle: Byks

Some good signs (1/5):

- **Wave Energy Actually WORKS!**





- a non-commercial metamorphosis:

from frog to prince !?

http://www.pico-owc.net ➔ livecam Pico OWC & online production graphs

Some good signs (2/5): importance of "neutral test sites" recognised

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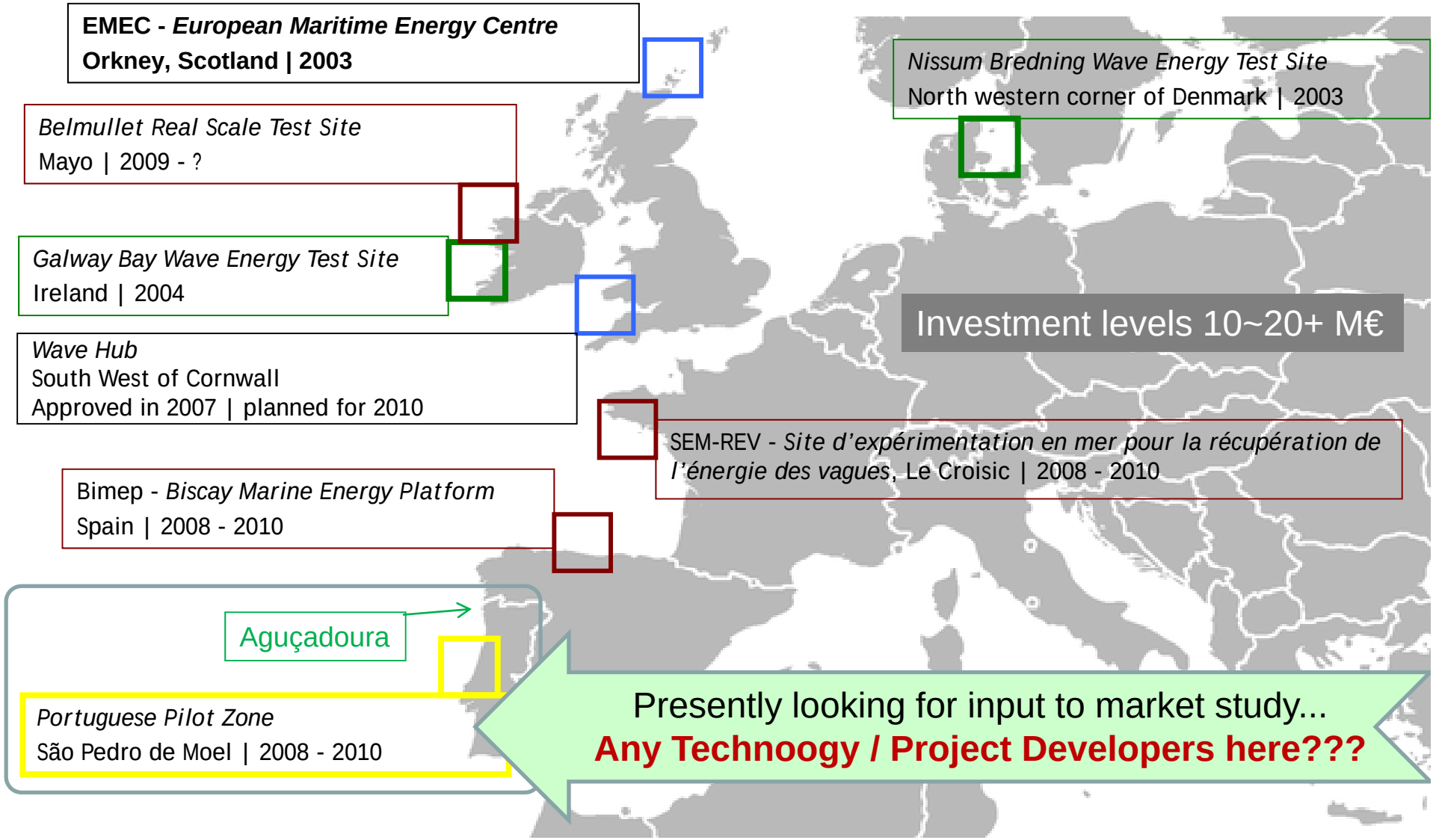
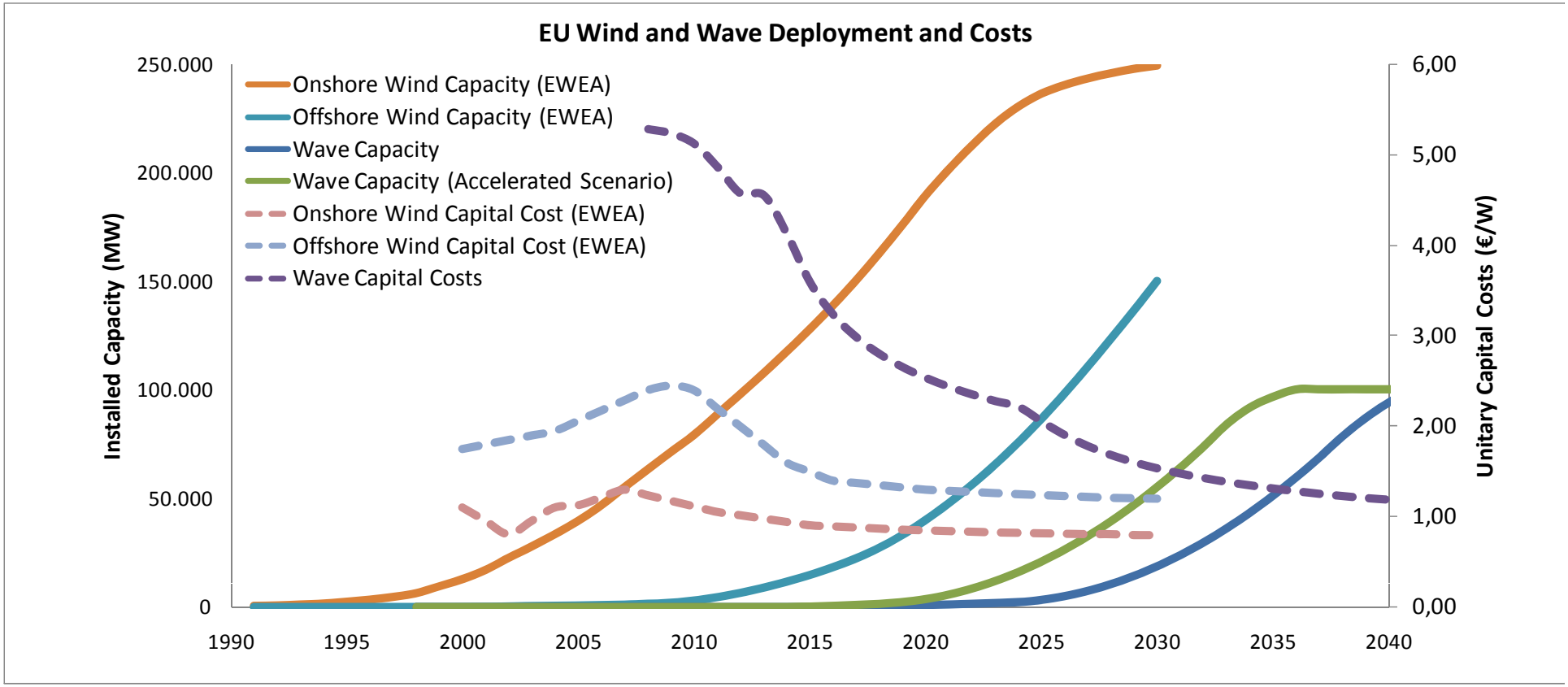
Equimar, Sowfia, MariNET projects (EC or EACI funding)



Some good signs (3/5):

- **Implementation scenarios and Roadmaps being established increasingly**



- **FITs even an accepted measure in North American market** (rather unusual)

Some good signs (4/5):

- **Wave Energy will actually mean business!**

Example Fishery ⇔ Wave energy in Portugal: an attempt of comparison

	Value	Unit
Annual Resource	155	Tons
Average Fish Price	2	€/kg
Total Annual Revenues	**255**	**M€**
Area	92088	km2
Revenue per Area Unit	**2769**	**€/km2**

Prog. Operacional Pesca 2007-2013. DGPA

Practical Power Potential	5.0	GW
National Practical Resource Potential	10000	GWh
Electricity Price	0.075	€/kWh
Potential Revenues	**750**	**M€**
Extension Usable Coast	250	km
Width Wave Farm	1	km
Usable Area	250	km2
Revenue per Area Unit	**3 000 000**	**€/km2**

NEEDS; Carbon Trust; WavEC (2004); Cruz et a. (2005)

- **...might not be as little "revenue-intensive" as commonly assumed!**
- **Technical synergis being explored (ORECCA, Marina,** Oceans of Tomorrow Call**)**

Several arguments to re-discuss priorities of ocean space use exist

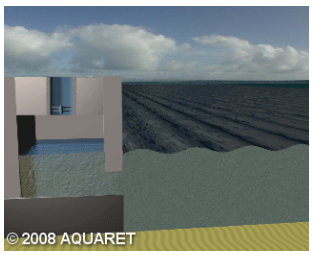
Some good signs (5/5):

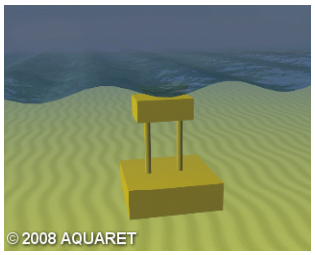
Example Portugal:

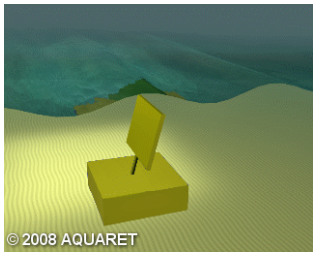
- "Public Policies and Dissemination Project" for was financed by 8 companies;
- Offshore Energy Institute and test infrastructures under iscussion (as PPP)
- WavEC inputs into public consulting (National Renewable Energy Plan, Operational Plan for Ocean Space, Integrated Coastal Zone Strategy) were well received;
- Active participation in discussion with authorities for future documents envisaged;
- Direct support of main licensing body (INAG) for floating wind project
- Protocol signed with public entity for ocean space issues (EMAM), joint seminar will be held; Governmental support for marine energy test centre clearly indicated;

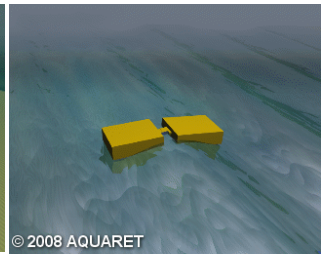
Some not so good signs... (1/3)

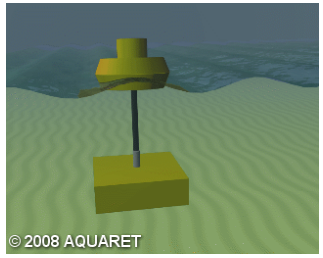
- **Still distinct for wave energy: large technological variety (no convergence)**

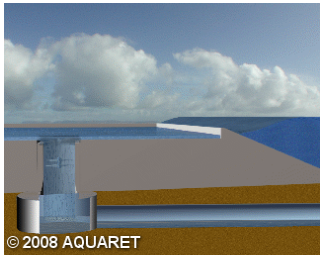






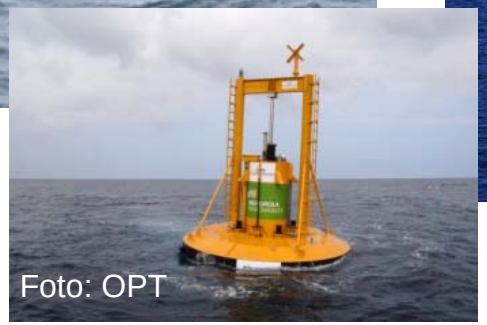


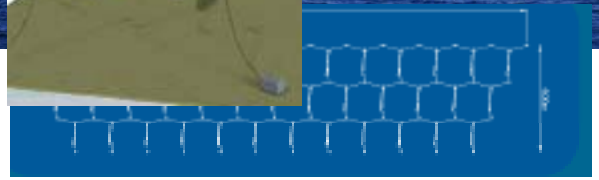




OWC	Oscillating bodies	Overtopping

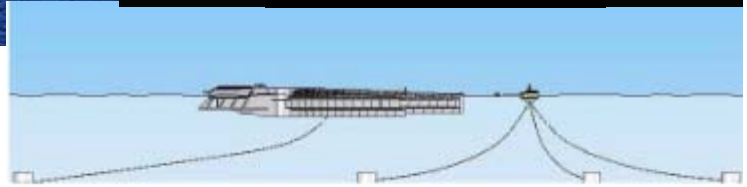
Foto: Ocean Energy





Source: Pelamis

Source: Wavedragon



Some not so good signs... (2/3)

- **Little expectations for 2020-target contribution; targets likely not to be met**

Country	Energy	2010	2012	2020
Ireland	Ocean energy	-	75 MW	500 MW
Scotland	Ocean energy	-	-	700 MW
Basque Country	Wave energy	5 MW	-	-
Portugal	Wave energy			500 MW
France	Ocean energy			6,000 MW

- **No real progress (yet) in how to overcome "Valley of death"**
  (field tests financing far below requirements; non-sufficient understanding of reality)

- **Private capital often VC characteritics – not really long-term philosophy**
  (is the 'free market-approach' the best solution???)

- **Only limited progress regarding traditionally 'weak' lobby** (compare e.g. PV)

- **EC and some other public funds apparently with negative trend**
  (though probably momentary due to 2020 priorities)

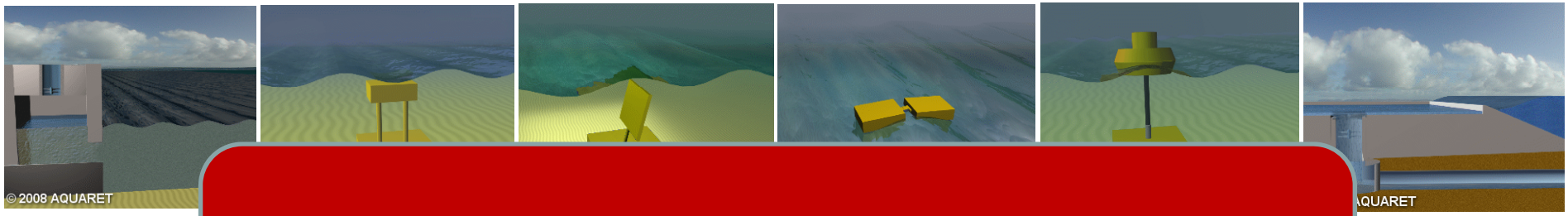
Some not so good signs... (3/3)

- **Technical 'performance' still behind expectations**
- **Demands** (seaworthiness/survivability/reliability) **at similar level like offshore oil&gas, but 'capital density' several orders of magnitue lower**
- **Uncommon geometry and operation requirements: 'need to be where it hurts most'** (water surface)
- **Real data sharing / joint developments of critical components not common**

- **ARE SUPPLIERS AWARE OF THEIR RESPONSIBILITY ???**
- **WE STILL NOT PERCEIVED AS REALISTIC OPTION BY WIDE PUBLIC**

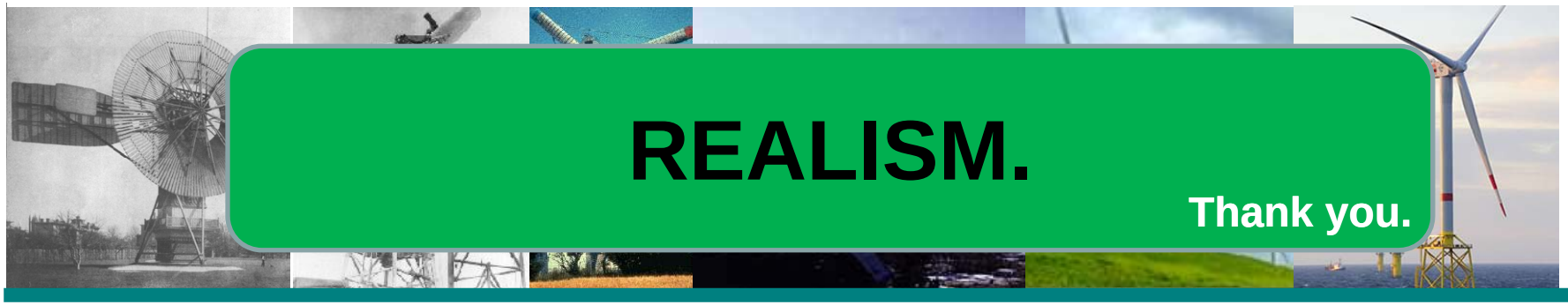
→ WILL WE ABLE TO CONVINCE THE PUBLIC TO PAY THE BILL???

...should we not expect some difficulties??



Most vital 'ability' for ongoing development phase:

1885: First m



REALISM.

Thank you.

1888, 12 kW | 1941, 1.25 MW | 70's/80's, 30 kW | 2007, 5MW