Marine Energy Activities in Spain

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tecnalia
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IEA | OES
Ocean Energy Systems

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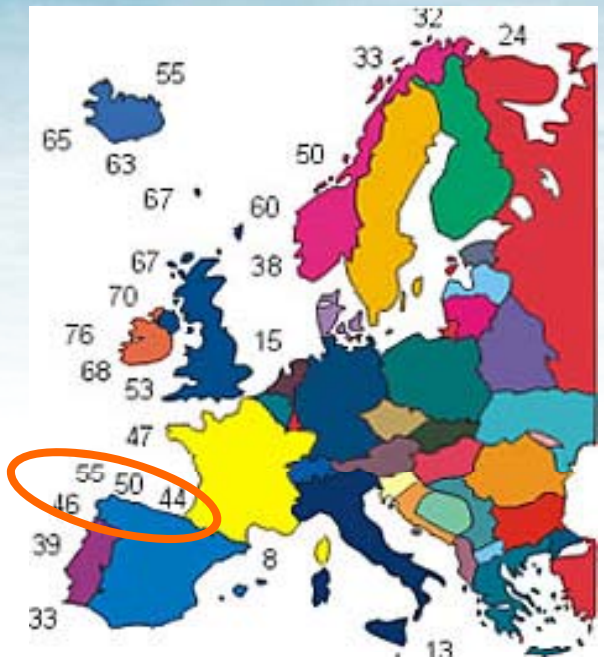
Resource

- Tidal range resource:
  - Spain has no appropriate sites (tidal range > 6m) except some commercial harbours with huge environmental impact and restrictions for other uses.
- Marine Currents:
  - Theoretical resource in the South (i.e. Strait of Gibraltar) and some river mouths not available due to navigation and other use restrictions
- OTEC (temperature gradient)
  - Insufficient thermal difference
- Salinity gradient:
  - Theoretical resource at river mouths
  - Important environmental impact, immature technologies
- Waves:
  - 40-55 kW/m on Atlantic and Cantabrian coastlines
  - Available resource: 21GW (source APPA)



Source: EC (CA-OE project)

Regulatory Framework and Policies

- **Targets:**
  - So far there are no national targets for ocean power.
    - IDAE (the Spanish Energy Agency) has announced the inclusion of wave power targets by 2020 in the new “Renewable Energy Plan 2011-2020”.
      - **Expected by mid-2010**
      - **Detailed wave resource atlas under development.**
  - Two regions in Spain have considered targets of wave power in their energy strategy
    - Basque Country: 5MW by 2010
    - Canary Islands: 50MW by 2015

- **Procedures** (Royal Decree 1028/2007 - July 20th)
  - This establishes the administrative procedure to apply for authorisation for electricity generation installations at sea.
  - It is mainly focused on offshore wind, but it also includes a simplified procedure for other marine technologies.

Regulatory Framework and Policies

- **Feed-in tariffs** for Renewable Energy Sources (Royal Decree 661/2007 - May 25th)
  - It included ocean power for the first time, with three different options:
  - 1. Fixed tariff
    - 6.89 c€/kWh (first 20 years), 6.51 c€/kWh thereafter
    - about 5 times lower than for photovoltaic, similar to onshore wind energy and lower than for offshore wind.
  - 2. Market participation
    - Market price plus bonus 3.84 c€/kWh
    - This bonus is much less than for offshore wind (8.43 c€/kWh)
  - 3. Possibility of negotiating a particular tariff for each ocean power installation though a comprehensive description is required
    - No references available
    - At least one installation has asked for this tariff (Mutriku breakwater) but no resolution so far
  - Current feed-in tariffs could be updated to facilitate the achievement of 2020 targets.

Research and Development

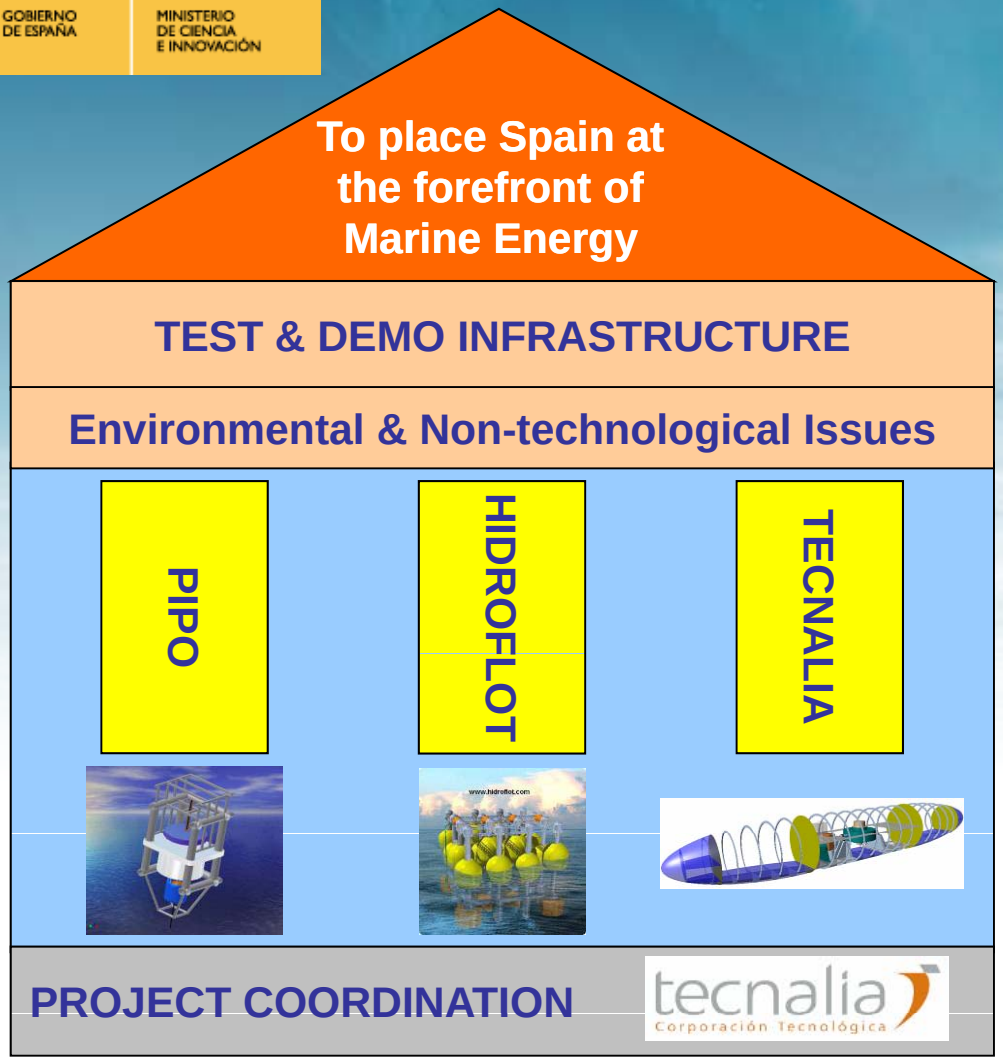
PSE-MAR

Main Spanish initiative in ocean energy research.

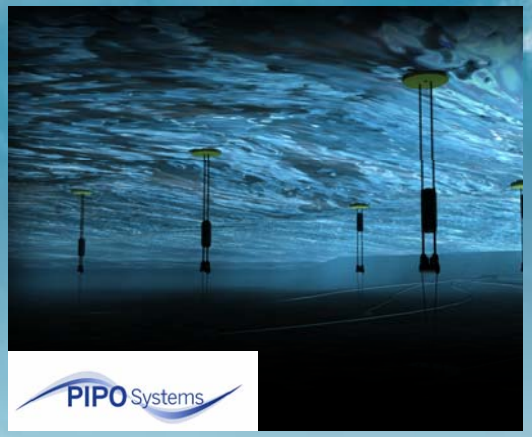
Total Budget: 25M€ (2005-2010)

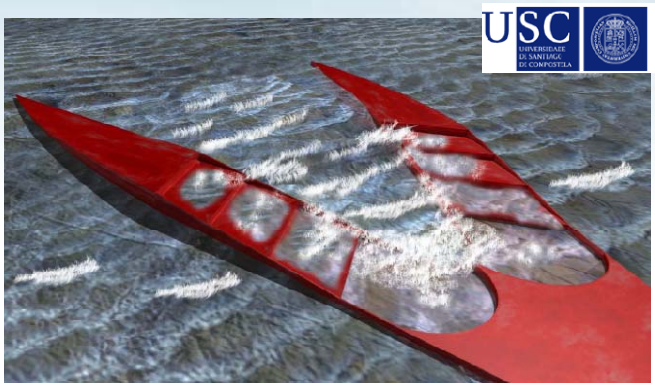
GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

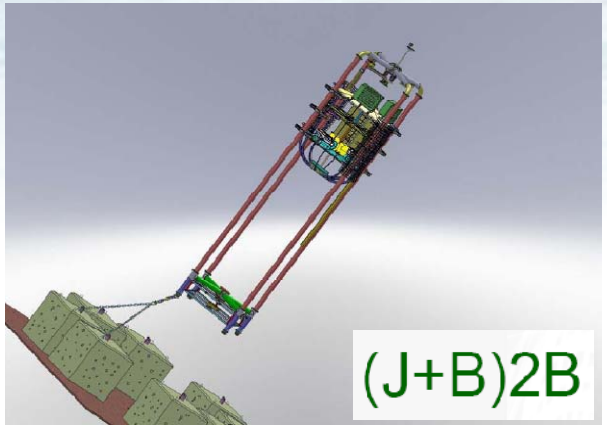
Development of the three most promising Spanish technologies for wave energy converters.



Research and Development







Research and Development

The end of 2009 saw the announcement of an important R&D project funded by the Spanish Government and led by Iberdrola:

30M€ budget – 15M€ public funding
40 months
20 industrial partners + 24 research centres

OceanLider includes several R&D activities with a holistic perspective:

1. **Resource and site assessment**
2. **Technology development (including combine systems with wind)**
3. **Grid connection**
4. **Operation and Maintenance**
5. **Installation**
6. **Environmental impact**

Research and Development:

Coordination with European partners

CORES - Components for Ocean Renewable Energy Systems - http://hmrc.ucc.ie/FP7/cores.html
New concepts and components for floating OWC systems
Funded by FP7, start: April 2008, 3 years
Leader: HMRC, University College Cork (Ireland)

EquiMar - Equitable Testing and Evaluation of Marine Energy Extraction Devices in terms of Performance, Cost and Environmental Impact - www.equimar.eu
Pre-normative research for Ocean Energy (Wave & Tidal)
Funded by FP7, start: April 2008, 3 years. Leader: University Edinburgh (UK)

WAVETRAIN 2 - Initial Training Network for Wave Energy Research Professionals - www.wavetrain2.eu
Marie Curie initial training network for Wave Energy
Funded by FP7, start: October 2008, 45 months. Leader: WavEC (Portugal)

MARINA Platform – Marine Renewable Integrated Application Platform - www.marina-platform.eu
Wind and Ocean Energy combination research.
Funded by FP7, start: January 2010, 4,5 years. Leader: ACCIONA (Spain);

Technology Demonstration

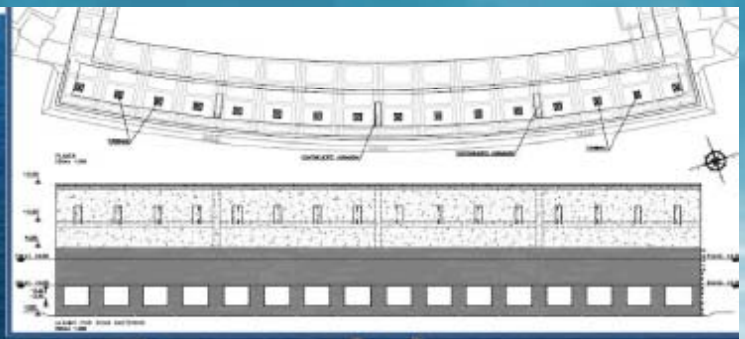
Santoña Wave Energy Project

- Promoters: IBERDROLA (60%), IDAE (10%), SODERCAN (20%), TOTAL (10%) and OPT (10%).
- Technology: OPT PowerBuoy
  - First step: 1 buoy 40 kW
  - Next, 9 buoys 150 kW (?)
- 40 kW PowerBuoy installed in September 2008
  - No grid connection
  - Few weeks in operation
  - Some improvements needed
- USP (Underwater Substation Pod) under testing

Technology Demonstration

Mutriku OWC plant

- OWC principle
- Multi-turbine WE plant: 16 chambers
- 18.5 kW/chamber
- Integrated into the new breakwater
  - Less visual impact
  - Shared civil work costs



2 chambers damaged in 2009
Turbines (Voith Hydro Wavegen) to be installed in 2010

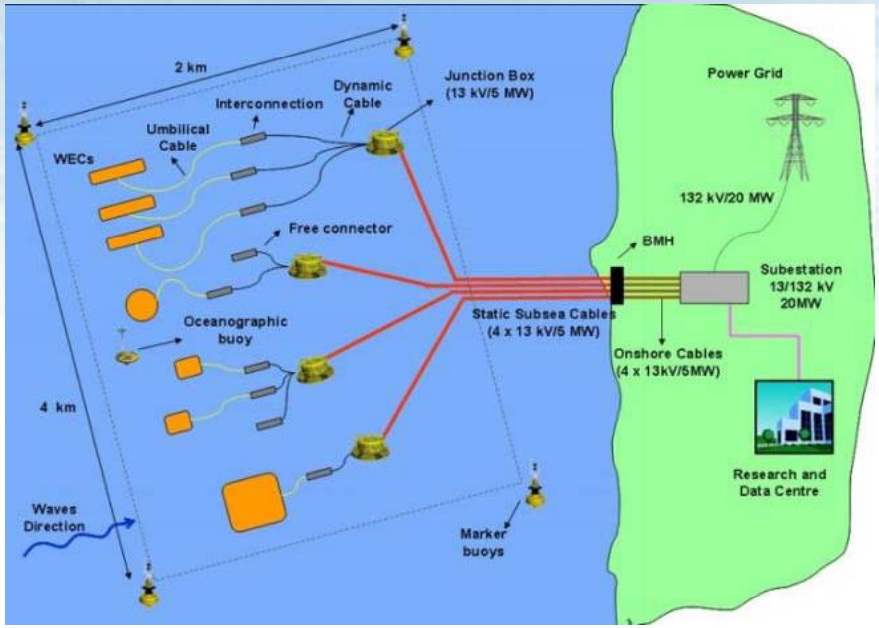
Technology Demonstration

Biscay Marine Energy Platform
bimep

4 x 2 km area located close to Bilbao (Bay of Biscay)

Infrastructure for **research and demonstration** of floating wave energy converters, which aims to place the Basque Country at the forefront of marine energy and create a technological and industrial sector around this energy

- Water depth between **50-90 m.**
- Closest point to the land about **1km**
- Overall power of **20 MW.**
- 4 berths (grid connection) **13 kV - 5 MW.**
- **4 subsea cables** - **onshore substation**.
- **Connectors** to make easier the connection and disconnection of WECs
- **Research and data centre**.
- Estimated budget about **20 M€**.
- Start of operation **end of 2011**
- **Oceanographic buoy** installed in Feb. 2009
- **Environmental OK** June 2009



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EVE | Ente Vasco de la Energía

Coordination activities

Marine Energy Industrial **Association** (16 members)

Working Group on Marine Renewable Energy under a Maritime **Technology Platform**

2 Spanish members with the Board of Directors of the **European Ocean Energy Association**

Participation in the **Standardisation Committee** IEC/TC114

Leadership of **WAVEPLAM project**: removing non-technological barriers for the development of Wave Energy in Europe: www.waveplam.eu

Member of **OES-IA** since 2008

Conclusions

Relevant **wave energy resources** exist although no other types.

National **wave atlas** under development

New **legal framework** is expected, which would include:

- National **targets** for installed power by 2020
- Medium-term system for higher **feed-in tariffs**
- Specific support for **demonstration projects**

Important **R&D activity**, coordinated with other European partners

Early stage for **Spanish Technology** Development of Wave Energy Converters and some research on tidal turbines.

New **test & demonstration facilities** and **2 demonstration projects** under construction.

Thank you for listening…
and see you in Spain

Bilbao Exhibition Centre,
6-8 October 2010
www.icoe2010bilbao.com

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