PECC Santiago Seminar

Energy transition Development of marine and Renewable Energies

Santiago Chile 24-25 June 2014

What policy measures are needed to develop MRE What kind of policy, technical, financial support?

Henri Boyé

French Ministry of Ecology,

Sustainable Development and Energy

Energetic transition

European Community commitments declined in 2020 ... ambitious national targets

20% reduction of GHG emissions
23% renewable energy
20% energy efficiency

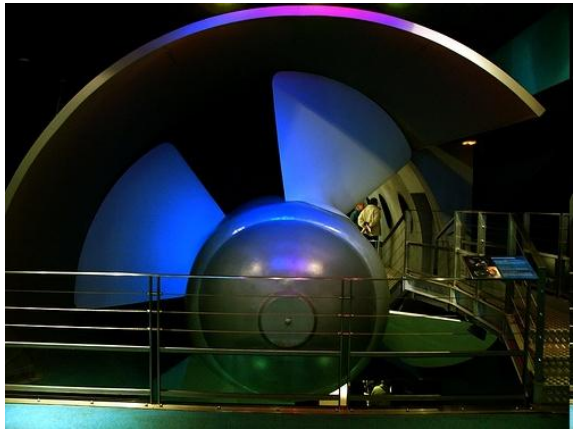
A long-term commitment: the "factor 4"
A indicative European "roadmap" :
minus 40% GHG by 2030
minus 60% in 2040
A Presidential Commitment
Reduce the share of nuclear power to 50% in 2025

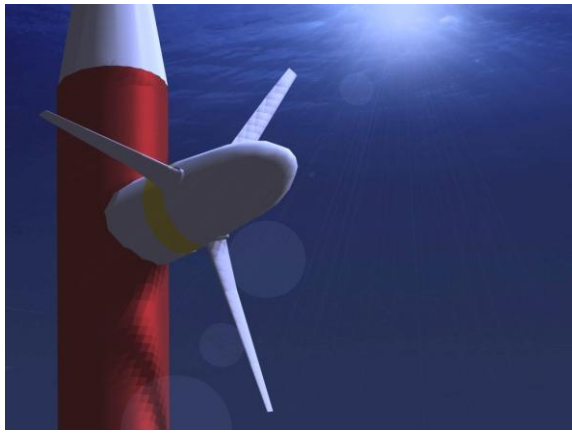
Earth is mostly ocean

Natural resource and Marine energy

Marine energy resources: a major challenge for the XXI century?

- Ocean accumulates thermal energy, and returns it in many forms
- Kinetic energy, potential energy, chemical energy, thermal energy ...
- Many types of marine energy
- wind
- Waves and swell
- currents
- thermal energy
- osmotic power





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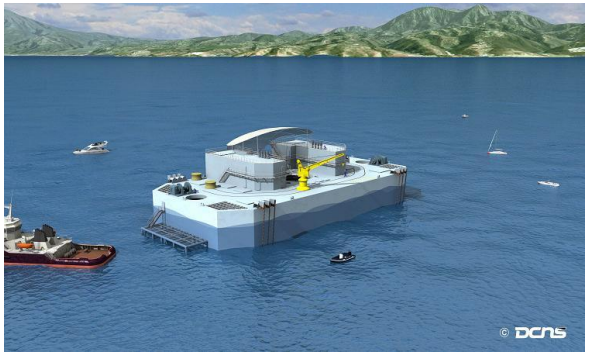
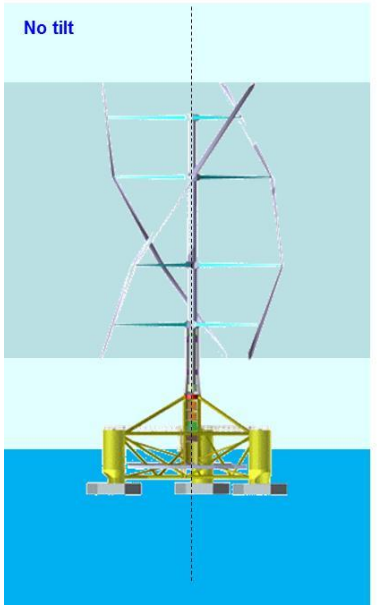
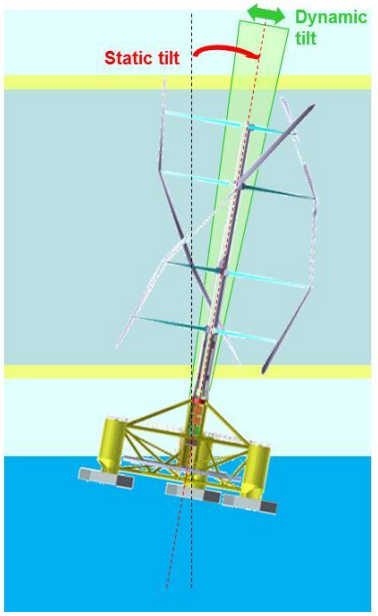
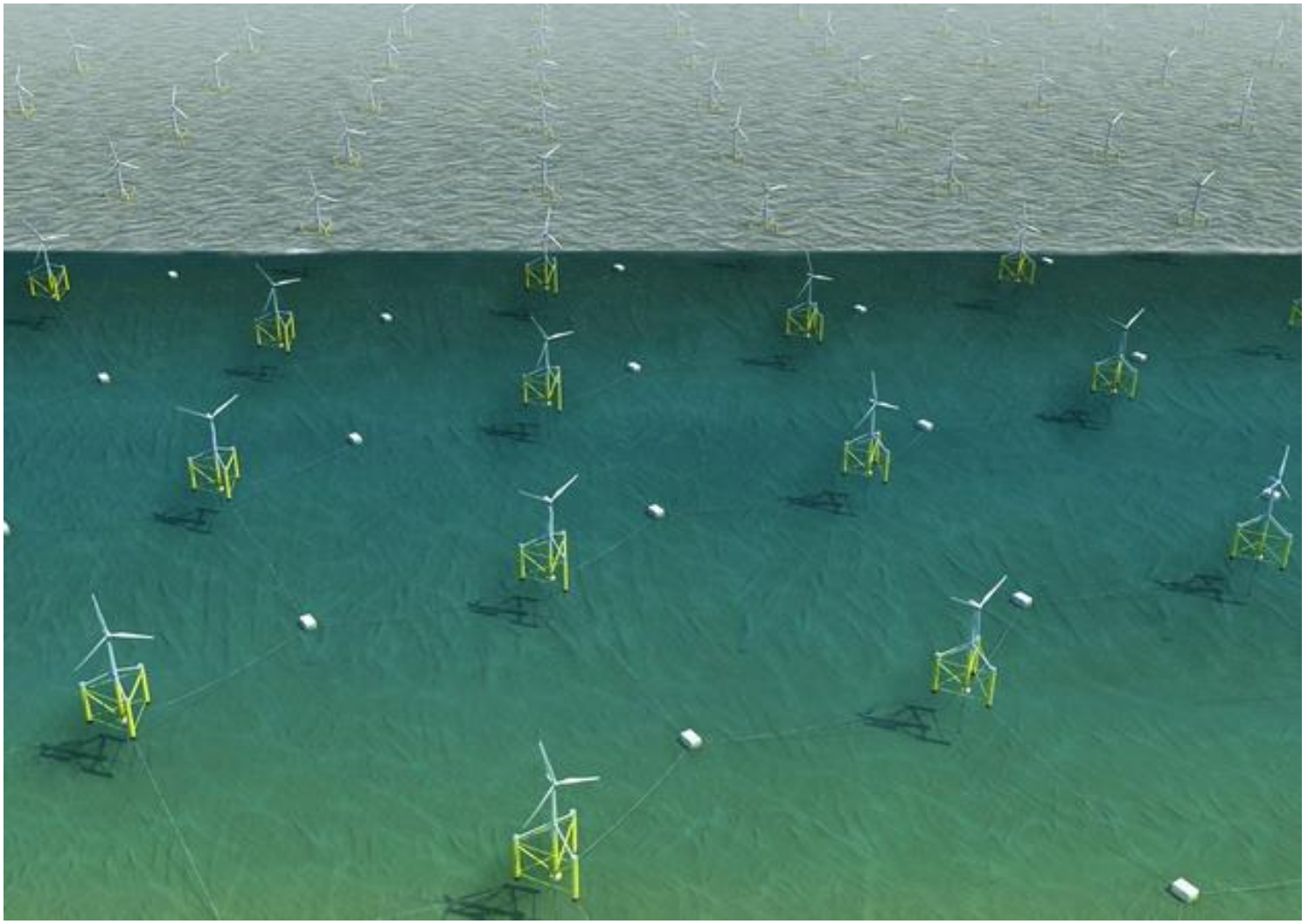


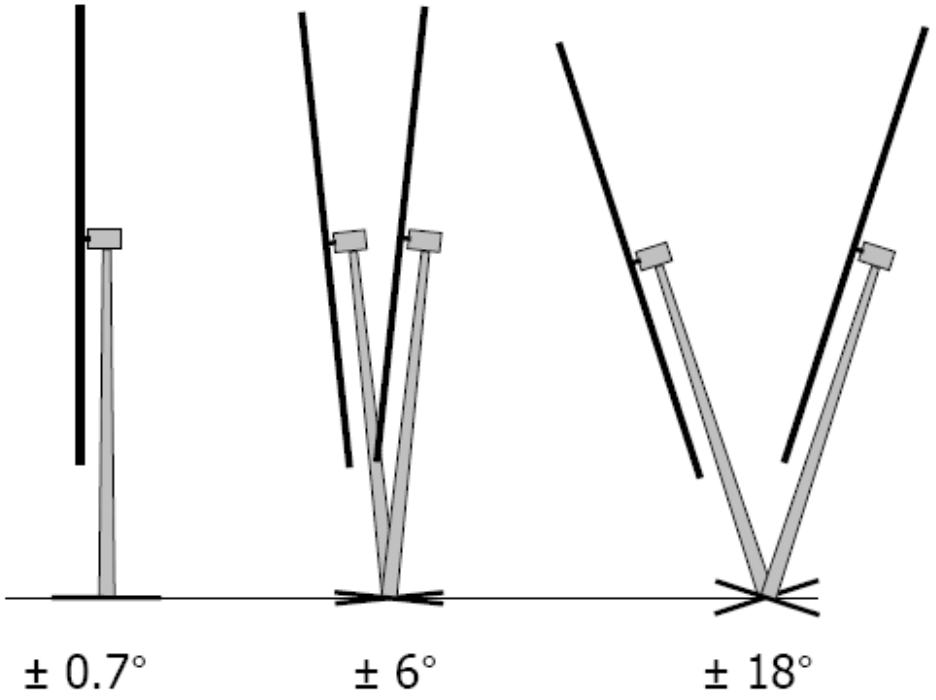


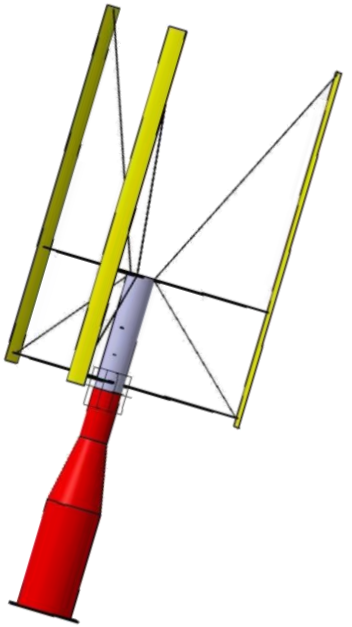


Floating Wind Project Winflo France



Nenuphar Wind
A wind turbine that can operate inclined





- Nacelle easily adjustable in front of wind

Comparable to an helicopter Operation

Reduced lifetime (fatigue mechanical parts)

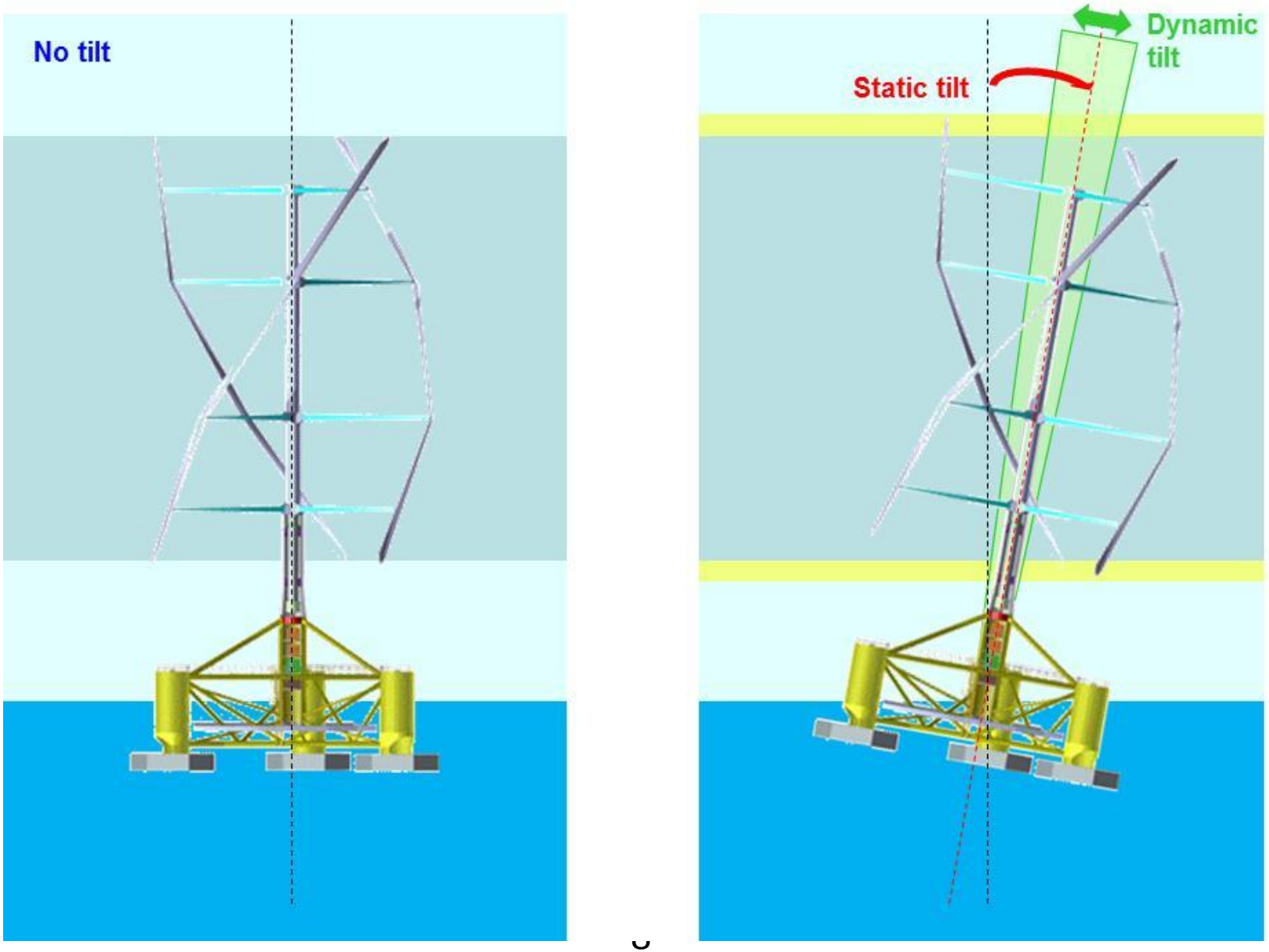
- No orientation of the nacelle system

No variable blade pitch

System "self-regulated" by strong winds

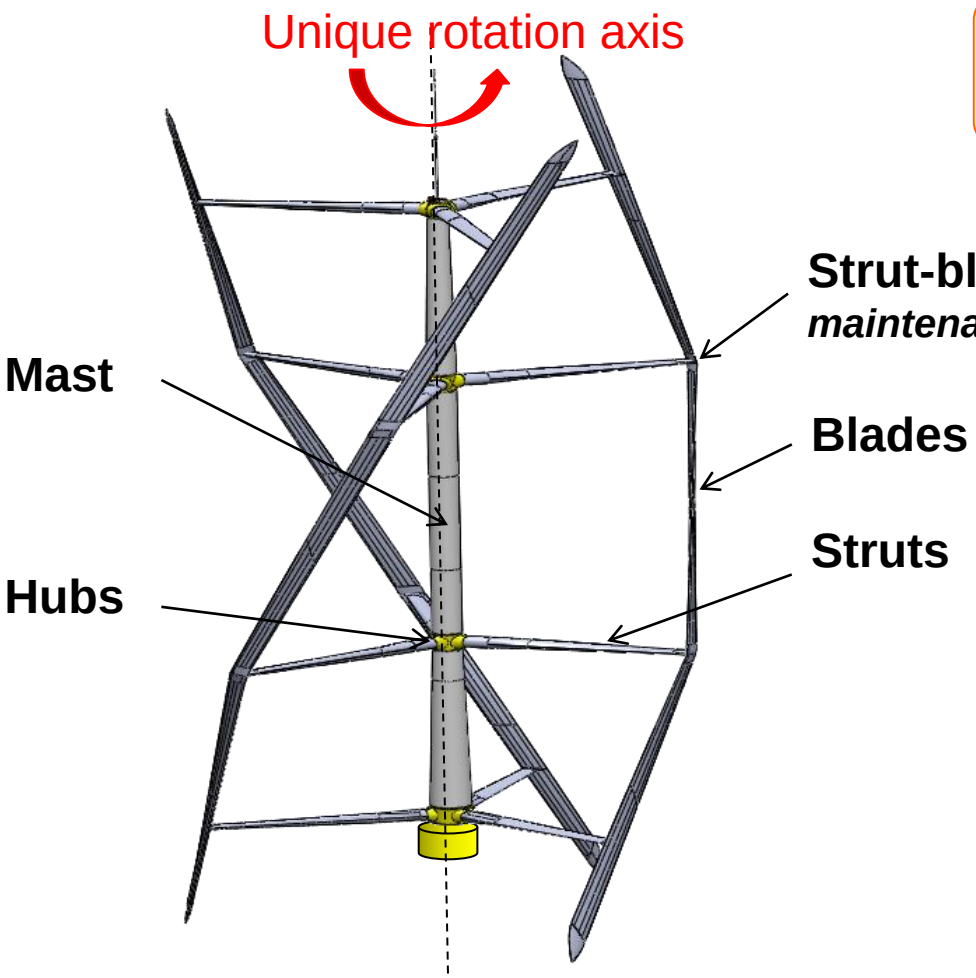
7

Nenuphar Wind
A wind turbine that can operate inclined



A single rotating part: the whole rotor

The rotor is simple and robust



Simple blade and strut shapes allow the use of low cost manufacturing techniques

Reduced number of rotating connections:
No yaw
No pitch
No actuator

A unique rotating connection:
the slewing bearing

Vertimed won in December 2012, the funding program NER300

A French project is selected VertiMED, led by EDF Energies Nouvelles (EDF EN).

It involves the construction of a site devoted to the production of electricity from wind turbines floating off Marseille.

It will benefit from EU funding of € 34.3 million.

NER300 program co-finances projects to 50% of the cost, with the remainder provided by private investors or governments.

The marine renewable energy innovation policies

State of the art in tidal energy, wave energy and floating windmills

Few mature technologies,
a large number of concepts at disparate stages of development

Case study of the hydrokinetic and tidal current public project in France, compared to UK development strategy.

What are the main criteria for the regulator and the government?
Risks, barriers and opportunities;
Financial mechanisms for R&D.

Some examples of public aids for a good cooperation and innovation development, incentives, public grants and feed-in tariffs, France Energies Marines, EMACOP…

MRE Many Questions ??

For a better and wider use of the new sources of energy from the oceans (thermal, wave, tidal, wind, etc.)

What are the available technologies and the new technologies and industries to be developed ?

How to manage and control the portfolio of new ideas and technologies, and engage in an industrial roadmap for the future?

Which ways to increase the use of energy from marine sources (research, incentives, etc.)

Role of marine energy, cost, and financing of necessary infrastructures.

A profusion of technologies: a selection is necessary

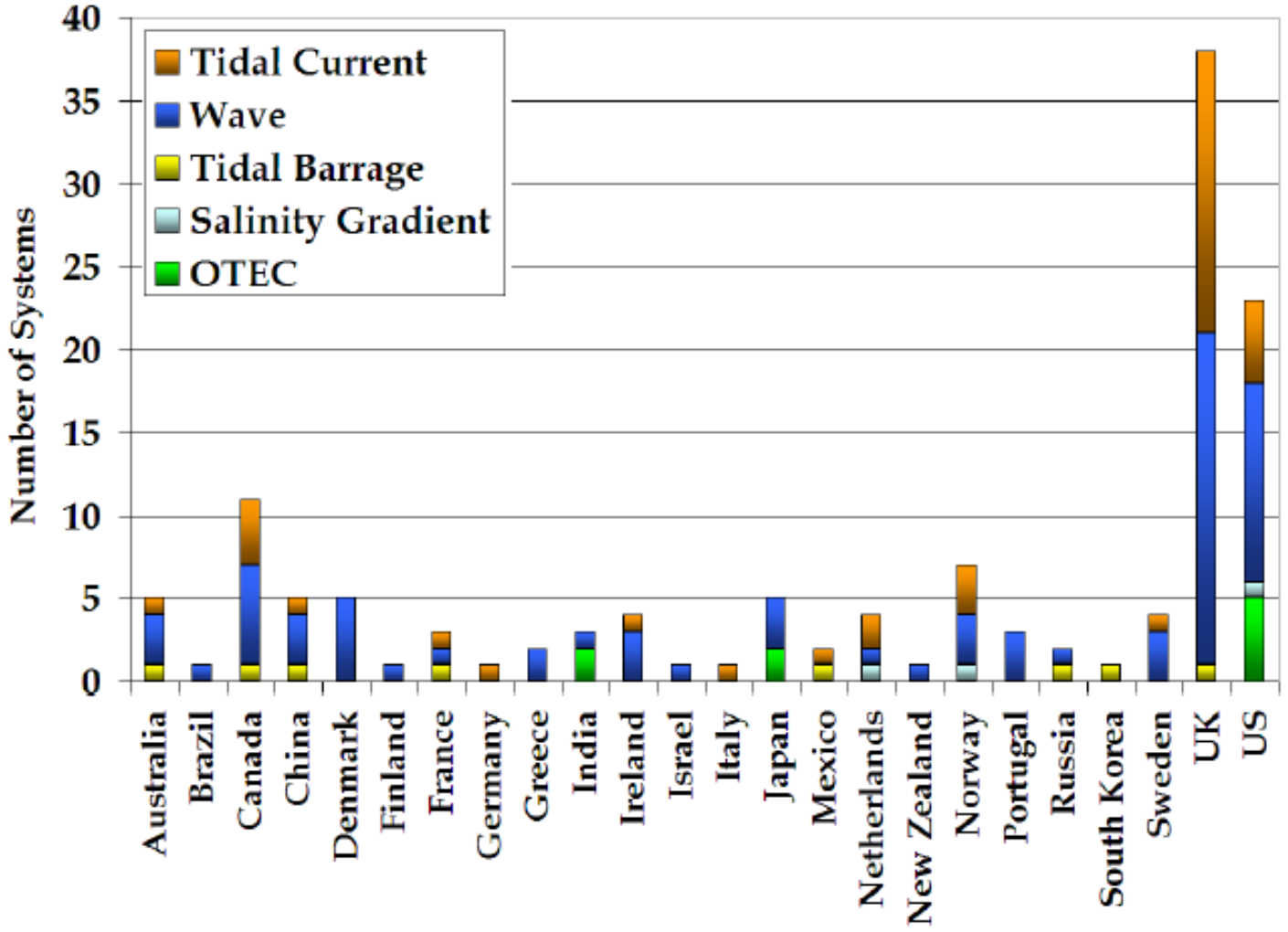
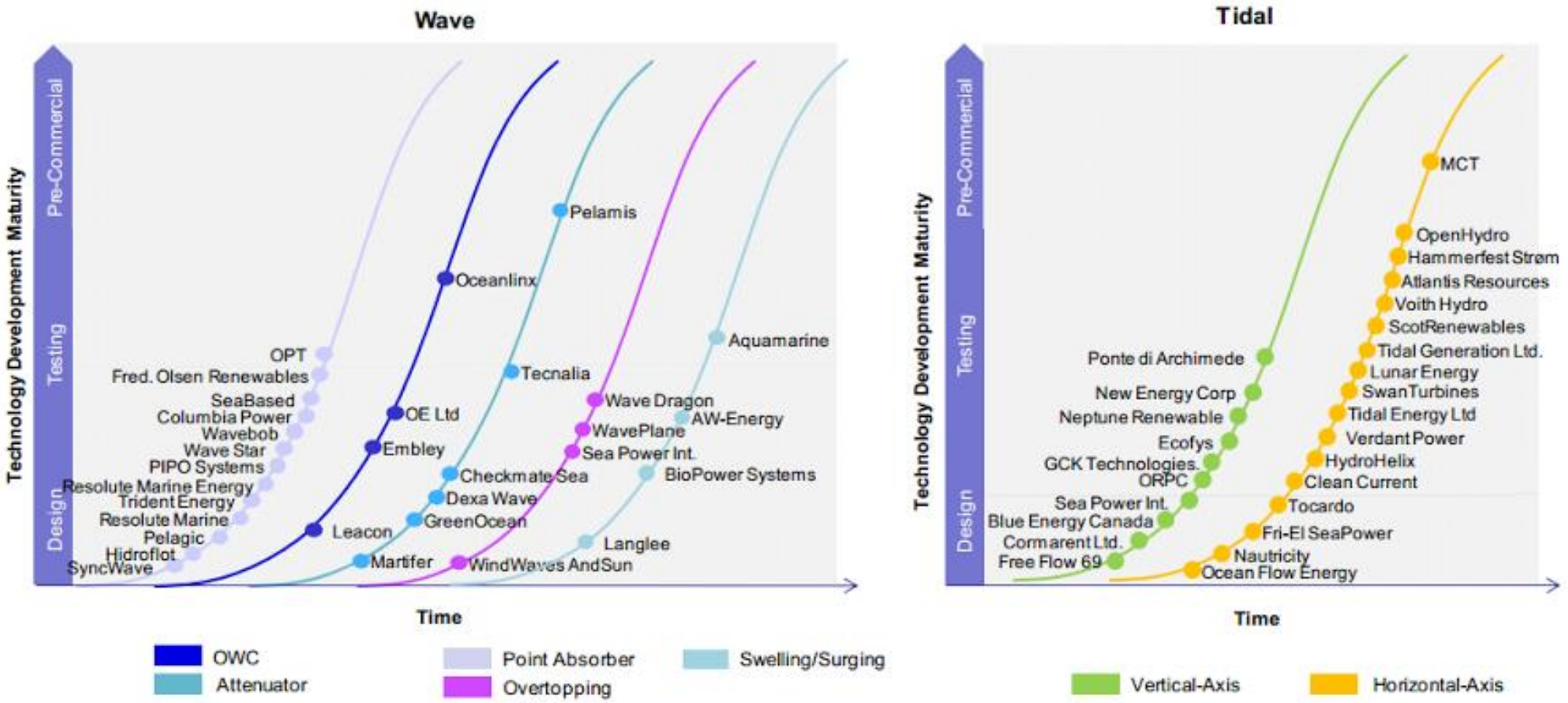


Figure 5: Ocean energy-related research, demonstration and commercial activities, as of December 2007

Technology Development Maturity



Note: Analysis excludes CETO technology and shoreline wave devices
Source: IHS Emerging Energy Research

The cost of Renewable energies

- Cost now, cost to morrow ?
- Financing ? Who pays, for what ?
- Feed-in Tariffs ? Or targeted grants ?
- For R&D, technologies and Projects,
- Industrial Policy, Manufacturing.

Mechanical Marine Renewable Energy Technological barriers

Construction of large scale and fine mesh metocean database

Development of numerical tools: seakeeping, energy conversion

Design of mooring systems

Materials: reliability, fatigue, corrosion, bio-fouling, life cycle

Operations at sea: deployment, inspection, maintenance, reparation, dismantling

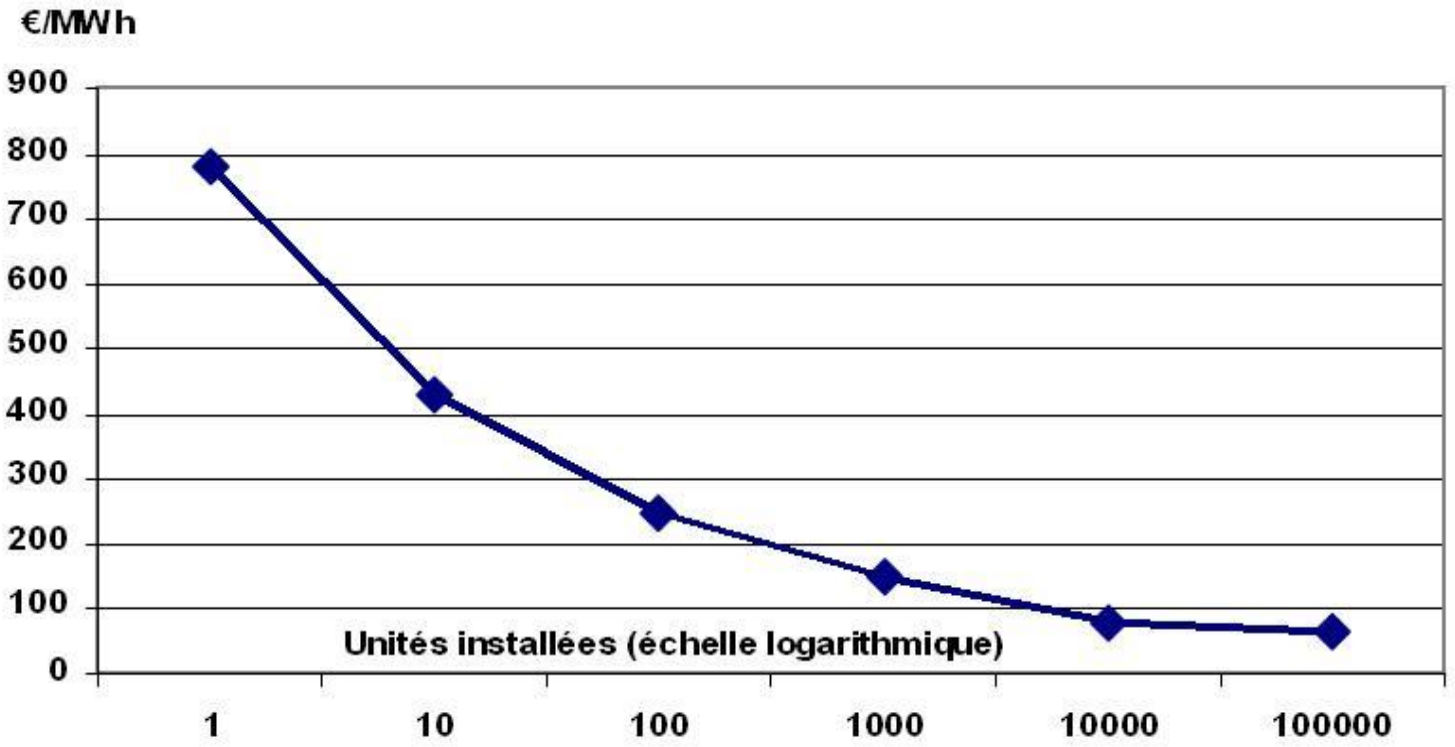
Connexion to the grid: underwater connectors, umbilicals

Energy storage: batteries, hydraulic, hydrogen?

Public Policies and barriers

- Simplification of licensing procedures for projects and entrepreneurs
- Access to the electrical grid
- Access to field data
- Promote internal market : •Feed-in tariffs ,
- Define internal market (% of energy mix)
- In spite of the very high expectations on wave energy, present costs are high and no operational experience is still available.
- A large number of barriers can be identified, most of which may be removed or significantly reduced with proper public policies

Industrial Challenge of Marine Energies Reduced Cost by Economy of scale ?



Is Moore's law valid for Marine energy as well as for transistors ?

The observation that steady technological improvements in miniaturization leads to a doubling of the density of transistors on new integrated circuits every 18 months

Building an industry ?
Some costs and competitiveness

	IInvestment(M€/MW)	Operating Costs (€/MWh)
Offshore windmills	2010 : 3 to 3,5	2010 : 150 to 170 2025 : < 100
Floating Windmills	2015 : 4	2015 : 180 to 200 2020 : 150 2030 : < 100
Current energy	2015 : 4 à 5 2020 : 3,5	2015 : 200 à 250 2020 : 150
Wave energy	2015 : 4 à 5 2020 : 3,5 2030 : 2,5	2015 : 200 to250 2020 : 150 2030 < 100
OTC	2015 : 20 2025 : 10	2015 : 400 2025 : 250

Operating cost s=
- 8 to10% of investment
  - •manufacturing
  - • implementation
  - • connection to grid
  - • dismantling
- 5 à 8 % de l'investissement
  - • opération (navires…)
  - • maintenance (spare parts…)
  - • insurance (2%)
- load ratio
  - • from 30% (wind)
  - • to 90% (OTC)
- span life 20 years

Stakes for development of MRE
Building an Industry
Financing and Incentive

- R&D grants They form the most important ingredient in stimulating the R&D industry.
- Test sites are an important infrastructure where precommercial designs can be validated. Test sites are usually government funded facilities.
- Revenue support :
- · Feed-in tariffs (FIT)
- · Renewable energy certificates (ROCs)

Financing and Incentives for MRE

- What are the available mechanisms?
- Which support instruments for renewable electricity are currently being implemented (in the Member States of the EU)?

- 1 **Investment Based Mechanisms** (subsidies, credits, loans)

- 2. **Quota systems** (Tradable Green Certificates, tendering)

- 3. **Fixed price systems** (Feed-in Tariff)

Feed-in tariff (FIT)

- A policy mechanism designed to accelerate investment in renewable energy technologies. It achieves this by offering long-term contracts to renewable energy producers, typically based on the cost of generation of each technology. Technologies such as wind power, for instance, are awarded a lower per-kWh price, while technologies such as solar PV and tidal power are offered a higher price, reflecting higher costs.

- FITs typically include three key provisions : guaranteed grid access, long-term contracts for the electricity produced, purchase prices based on the cost of generation

- Ex : PORTUGAL Feed-In Tariff for Marine Renewables at 0,33 Euro/kwH

-

Investment based Mechanisms
subsidies, credits, loans

French Fundings by the CGI (Commissariat Général aux Investissements)

5 projects in Marine renewable Energies in 2011

Wave energy S3 SBM Off-shore, Ecole Centrale de Nantes PACA

Tidal turbines
SABELLA Sabella, Ifremer, Veritas Ile d'Ouessant
ORCA Alstom Power Hydro,

Floating Windmills
WINFLO DCNS, Nass & Wind, Saipem, Winacelles Brest

VERTIWIND Technip, Nenuphar, Converteam Douai
Winner ot the European NER Project

Pilot Farms Call for tenders in 2014

French Test Sites with France Energies Marines (as the EMEC in Scotland)

France Energies Marines

Mapping members and associated partners

Public-private partnership

Privés

Publics

The test sites : Advantages of a national coordination

- Teams and equipment shared between sites
  Optimization of the different steps related to sea trials

SEENEOH
Bordeaux
Tidal
Estuarine
Test site

SEM-REV
Floating
Marine
Converters
Test Site

Paimpol
Bréhat
Tidal
Energy
Test site

Groix
Test
site

Gulf
of Fos
Test site
(MISTRAL)

- Development of a database linked to the resource and the environment on a wide range of conditions
- A collective approach in interactions and positioning related to the regulatory framework, insurance, etc. certification

EMACOP

(Energies MArines, COtières et Portuaires)

A National Research Programme
for Marine Renewable Coastal and Portuary Energy

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CGEDD

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