HiPRWind: Offshore wind in deep water

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Outline

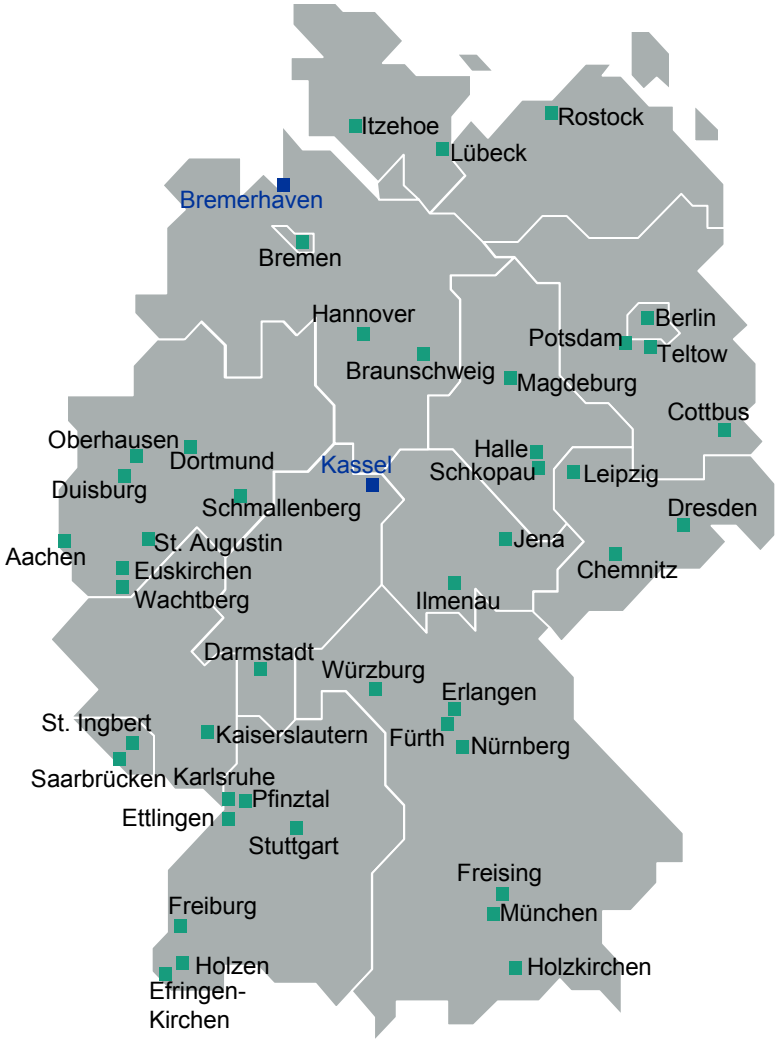
1. Our organisation
2. Floating wind and offshore renewables
3. The HiPRwind work programme
4. Current status
5. Expected impact

1. Fraunhofer-Gesellschaft in Germany

60 institutes at 40 locations

2010	
Staff	18130
Turnover	1 653 M€
↳ R&D	1 397 M€
↳ Industry	459 M€

- Institutes
- Branches of Institutes, Research Institutions, Working Groups, Branch Labs and Application Centers



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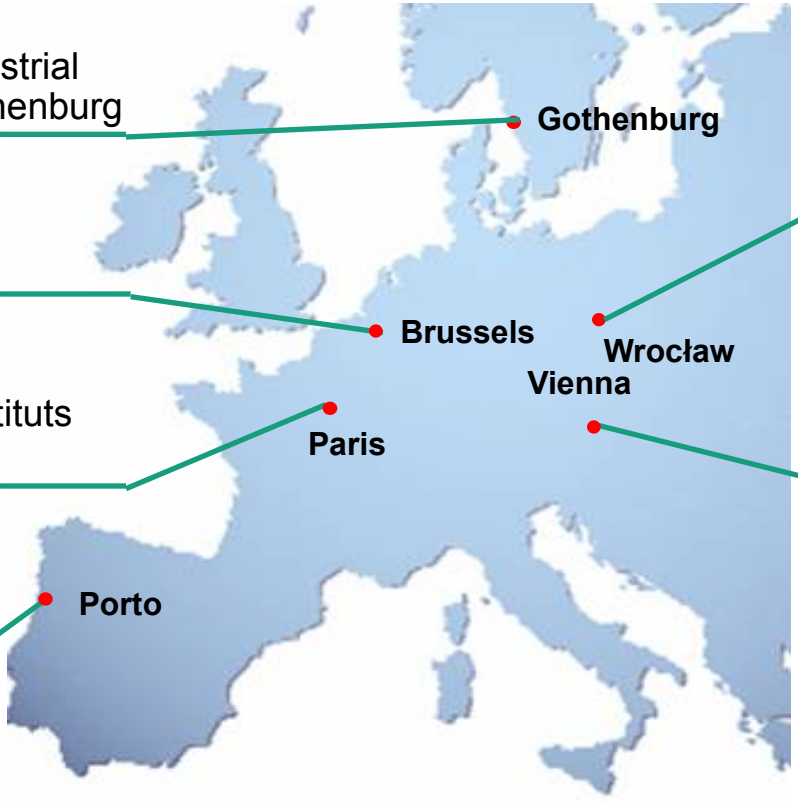
1. Fraunhofer-Gesellschaft in Europe

Fraunhofer-Chalmers Research Centre for Industrial Mathematics (FCC), Gothenburg

Fraunhofer-Gesellschaft Bureau Brussels

Fraunhofer-Cooperation with "Association des Instituts Carnot"

Fraunhofer Portugal Research Associação



Fraunhofer Project Center for Laser Integrated Manufacturing in cooperation with Politechnika Wrocławska

Fraunhofer Austria Research GmbH

- 7 Fraunhofer USA Centers
- 4 offices in Asia
- activities in Russia, the Middle East and India

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1. Fraunhofer IWES: Profile

Research spectrum:

- Wind energy from material development to grid optimization
- Energy system technology for all renewables

Annual budget: approx. 22 M€

Personal: 230 (full-time: 160) at two locations (Kassel and Bremerhaven)

Directors: Prof. Dr. Andreas Reuter, Prof. Dr. Jürgen Schmid

Main facilities:

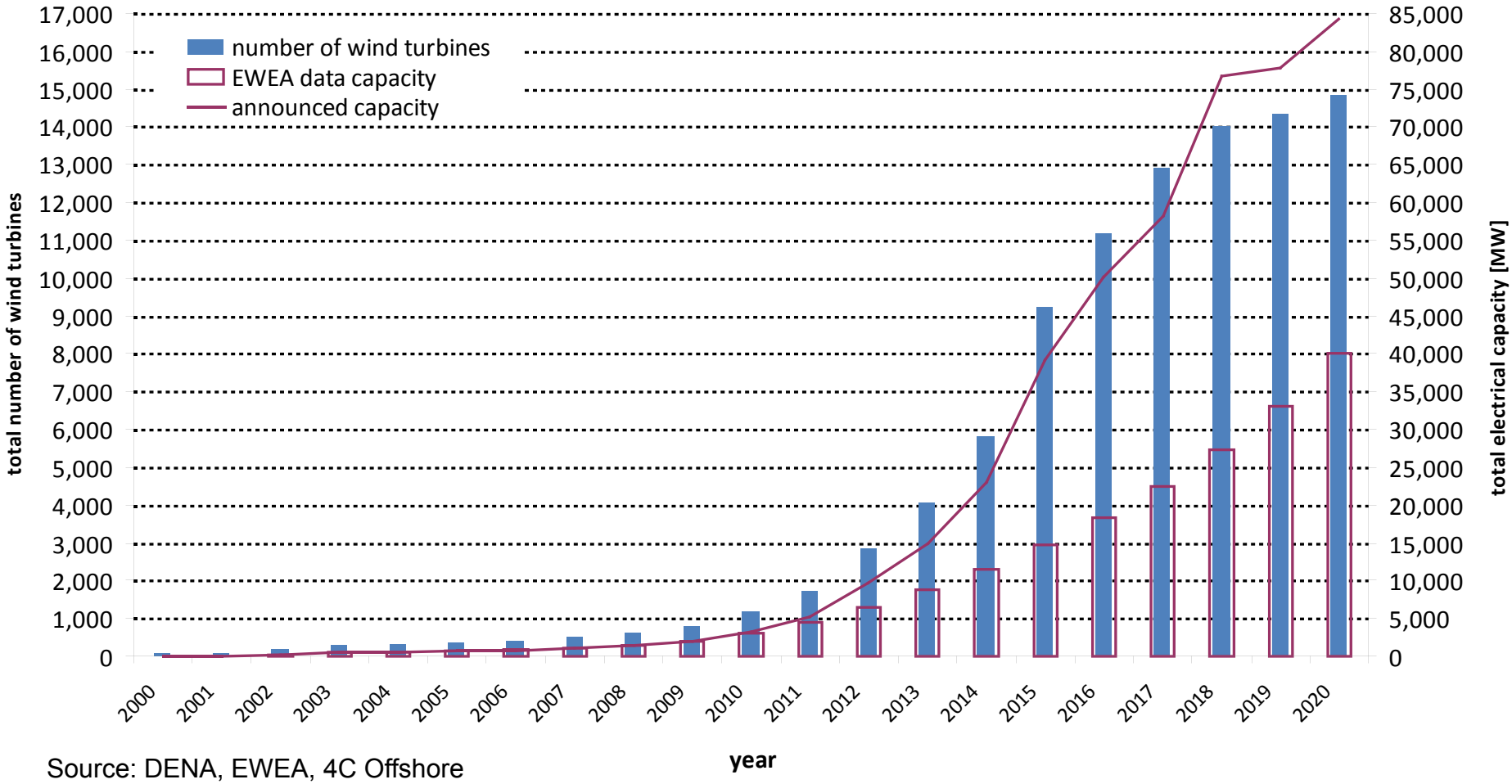
- Rotor blade test stands
- Nacelle test bench (2013)
- Electro-technical test stands
- Wind measurement network in Germany
- Material testing offshore and in climate chambers

1. Fraunhofer IWES: Business fields and projects

- Wind energy technology and operating management
- Dynamics of turbines and components
- Competence center rotor blade
- Environmental analysis for wind and ocean energy
- Control and integration of decentralized converters
- Energy management and grid operation
- Energy supply structures and systems analysis
- Marine energies

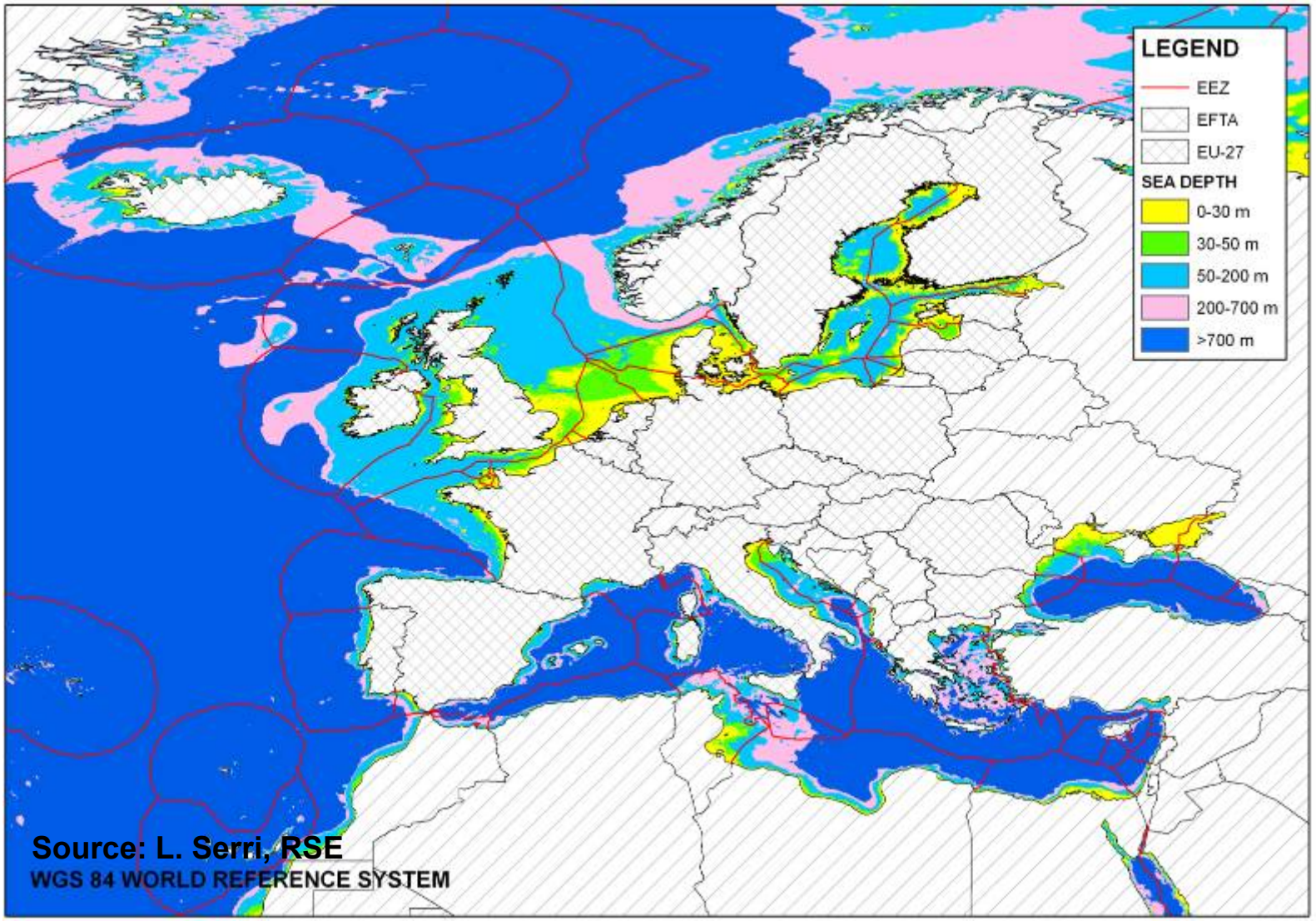
- Current projects include RAVE (First German offshore wind park), ORECCA, OC4 (IEA), MARINA Platform, Marinet, Pulse Tidal
- Past projects include Upwind, CORES, Seaflow, Seagen, Kobold I+II
- Member of IEA-OES and Wind, IEC TC 88 and 114, EERA Wind

2. European offshore wind market development: EWEA scenario and “project pipeline”

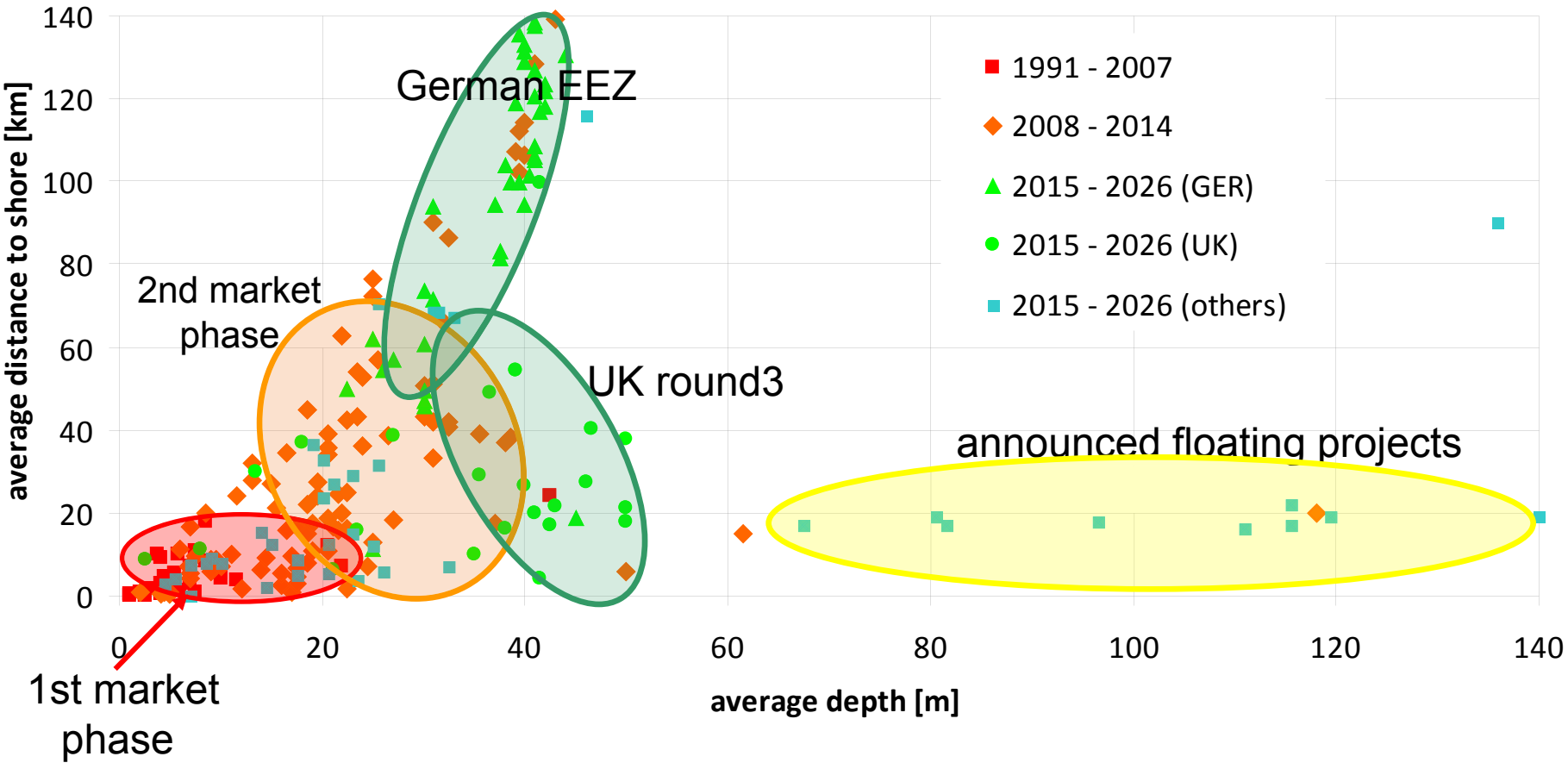


Source: DENA, EWEA, 4C Offshore

2. European EEZs and bathymetry map

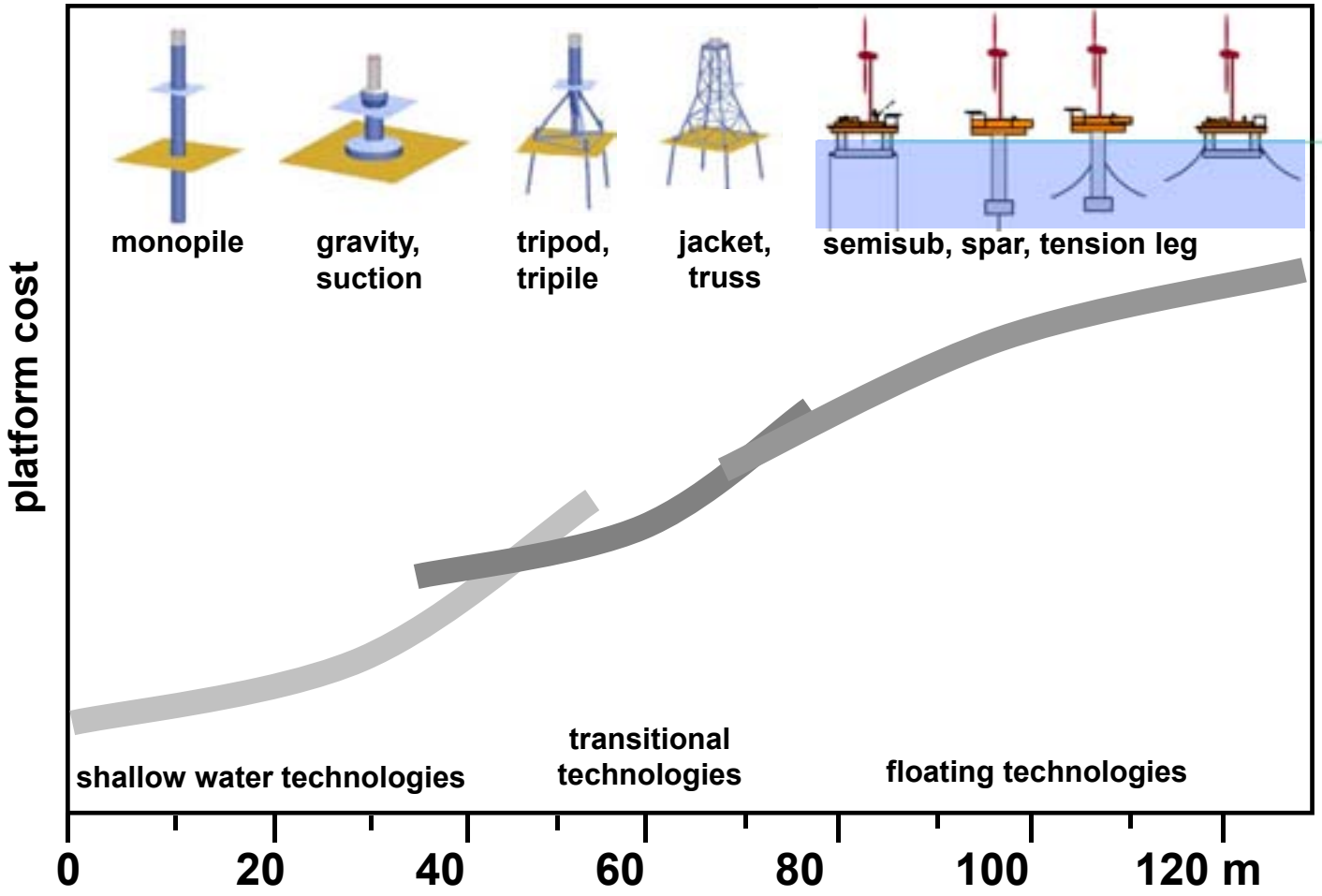


2. Development phases of the EU offshore wind market in terms of water depth (m) and distance to shore (km) up to 2025



WWW.ORECCA.EU

2. Platform technologies change with water depth



Source: NREL, NTNU

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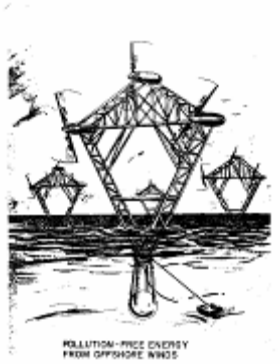
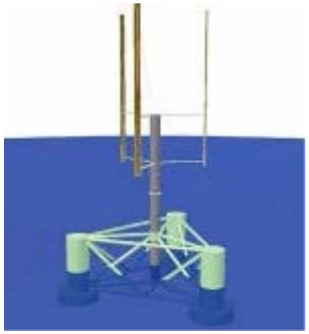
2. Floating concepts: project examples





…and many more…

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2. Cross sectoral projects and vision

- ORECCA:
  Ocean Renewable Energy Conversion Platforms - Coordination Action
- Marina Platform – research on multipurpose platforms (FP7 2010-2014)
- MARINET: EU-research infrastructure project for offshore wind and OE
- Oceans of Tomorrow : sustainable use of the oceans
- Combined Wind-Wave- , Wind-Tidal- etc. under preparation

- EC vision:
  combining Offshore Wind, Ocean Energy and other uses with regard to
  - area (Maritime spatial planning)
  - offshore grid
  - components, technologies and structures
  - supply chain…

  ➔ **Create a common offshore renewables market**

3. HiPRwind: key facts and figures

„High Power, high Reliability offshore wind technology“

Project coordinator: Fraunhofer IWES

- Funded under the European Commission‘s 7th Framework Programme
  - Main source for European R&D funding, 50+ billions € over 7 years
  - Theme ENERGY.2010.2.3-1: Cross-sectoral approach to the development of very large offshore wind turbines
  - Involvement of offshore industry stakeholders required

- Project start date: November 1, 2010. End date: October 31, 2015
- Total budget 20 million €, total EC-funding 11 million €
- 1130 man months over 5 years

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3. HiPRwind: Programme

- Aim:
  install and operate a floating MW-class wind turbine for research purpose

- Potential Location:
  Spain

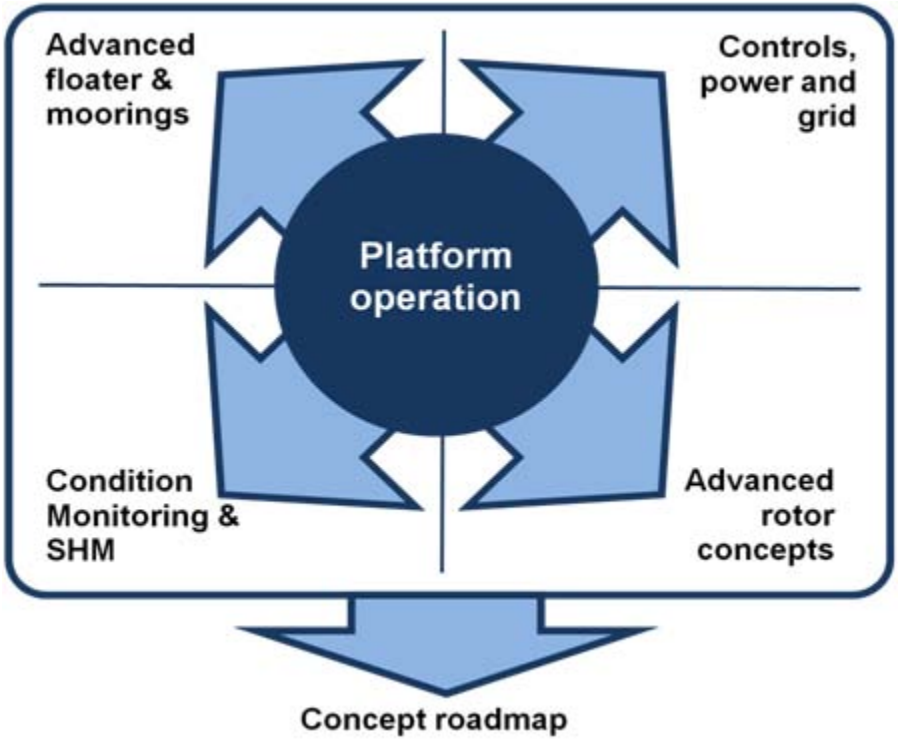
- Industrial challenge: design, procurement, construction and installation of the floating WT within three years of project start and within the available budget

- Research prospects: „unrestricted“ access to data from experiments on a real wind turbine in harsh offshore conditions during at least two years

3. HiPRwind: Work plan

Main research topics:

- Floater and mooring systems
- Controls, power and grid
- Condition and structural health monitoring
- Advanced rotor concepts



Timing:

- 1st year: design of the floating platform and of the research equipment
- 2nd and 3rd year: procurement, construction and installation of the floating WT
- 4th and 5th year: WT operation and maintenance for experimental research

3. HiPRwind: Consortium

Industry

Acciona Energia (Spain)
Acciona Wind Power (Spain)
ABB (Switzerland)
Bureau Veritas (France)
IDESA (Spain)
Mammoet (Netherlands)
Technip (France)
Vicinay Cadenas (Spain)

R&D SMEs

Micromega (Belgium)
Olav Olsen (Norway)
Wölfel berat. Ing. (Germany)
1-Tech (Belgium)

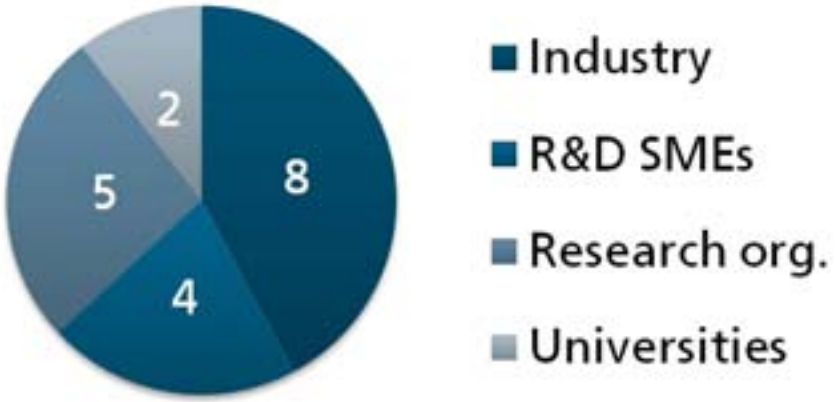
Universities

NTNU (Norway)
University Siegen (Germany)

Research org.

Fraunhofer IWES and IZFP
Narec (UK)
SINTEF (Norway)
Tecnalia-Robotiker (Spain)
The Welding Institute (UK)

A strong consortium with experience in offshore developments:



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4. Status of the design process

- 10 partners working under Acciona Energia's lead
- Review and evaluation of basic design options completed
  - Semi-sub selected
  - TLP and spar now ruled out for HiPRwind
- First general sizing completed
- Iterative analysis (structural, seakeeping, operations/installation) ongoing

- WP1 is on its way to delivering the structure on time. Many exciting challenges and a deadline at the end of 2011.

- Communication with Spanish authorities ongoing regarding permitting

4. Challenges in the design process

- Iterative design process
- Competences, contributions and roles of the partners
- Available software tools, interfaces between the tools and partners
- Design framework (Metocean, wind turbine, budget, …)
- Turbine modification vs platform stability; Moorings and station keeping
- Assembly, Installation and Commissioning Procedures
- Operation and Maintenance concept
- Generation of a reliable budget for manufacturing, assembly, installation and operation
- Certification and Permitting requirements for the offshore site
- ….

5. Expected impact of HiPRwind

- Encourages **international collaboration** across Europe
- Delivers **R&D field results** for the benefit of the industry
- Showcases **European know-how**
- Promotes **Spain** as a technology leader for floating wind
- Supports the formation of a „**floating wind community**"

- Interacts with a cluster of European projects to maximize the impact:
  - **ORECCA**: Development of an offshore wind-wave-current roadmap
  - **Marina Platform**: Research on multi-purpose platforms
  - **Marinet**: Experimental infrastructure for offshore renewables research
  - **Oceans of tomorrow**: sustainable use of the oceans
  - Further combined wind, wave and tidal projects (demo calls, NER 300)

Thank you, gracias. For more information…

- Your questions are welcome!

- Website: www.hyperwind.eu
- Contact:

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