

# ForWind – Center for Wind Energy Research

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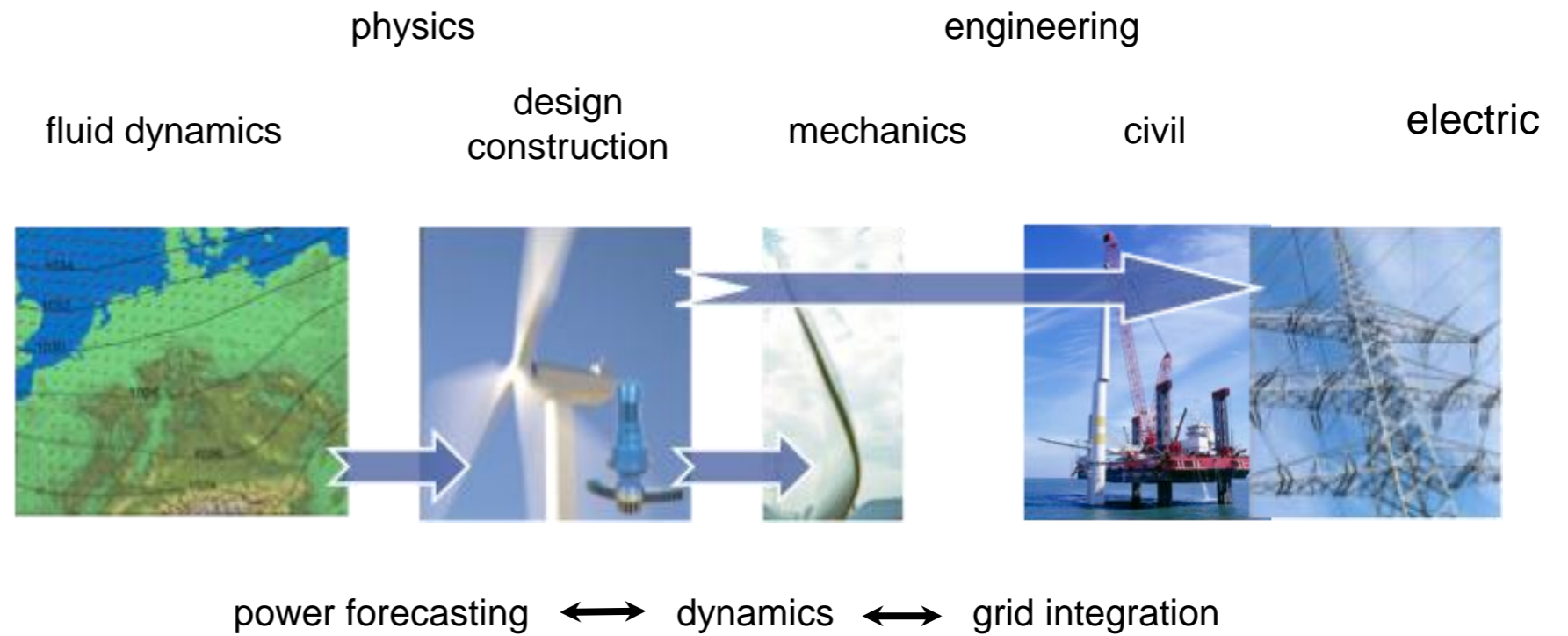
## **European Academy of Wind Energy and the European Wind Energy Master Program – Study Programs at the University of Oldenburg and in Europe**

NAWEA Symposium 2015, Virginia Tech, Blacksburg, VA

June 10, 2015

# Agenda

- 1. ForWind and European Collaborations**
- 2. Local and International Master Programs**
- 3. European Wind Energy Master (Erasmus Mundus)**
- 4. Online Certificate „Advanced Wind Energy“**
- 5. Continuing Education for Professionals**



Part 1

# FORWIND & EUROPEAN COLLABORATION

# 1981: University of Oldenburg was the first to establish a „Renewable Energy Lab“ in Germany

## Passive house design:

- Electrical System: wind turbine, solar panels, batteries
- Heating system: solar thermal, geo thermal, storage
- Biomass generator for heat and electricity



## Research at the Dept. of Physics:

- „physics of renewable energy sources“
- measurements and simulations
- component and system behaviour

→ First university research group for Renewable Energy in Germany



# Today: Energy Systems Research is at the Forefront of the Energy Transition



## Renewable Energy Sources

- Wind Energy, Turbulence
- Energy Meteorology
- Photovoltaics, Solar Cell Materials

Turbulent Wind Tunnel operative in 2016:



## Energy Efficiency

- Fuel Cells
- Energy Saving IT

## Energy Systems

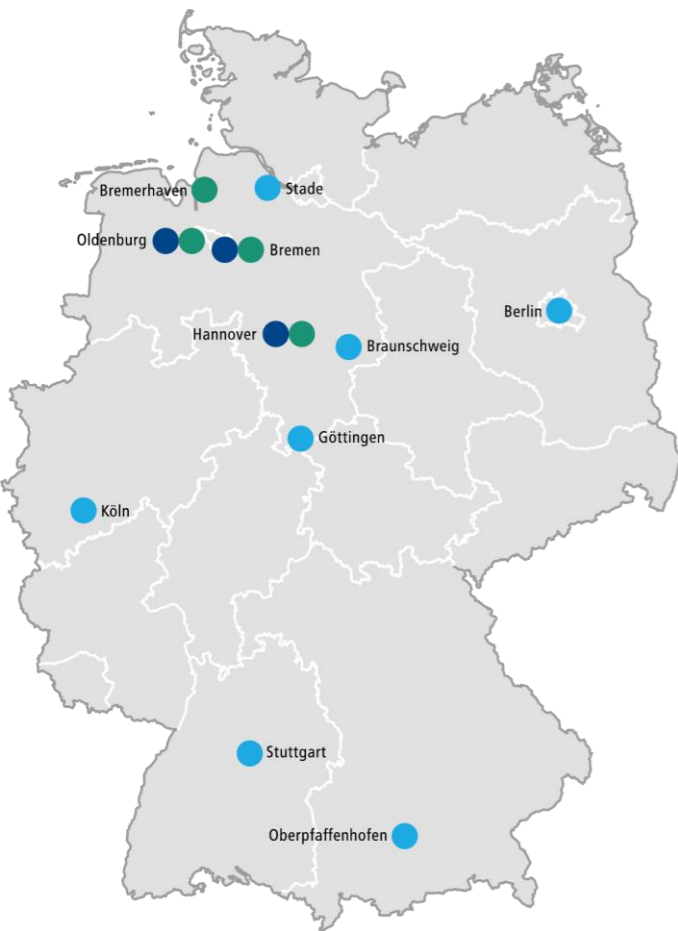
- Energy Economics, Sustainability
- Storage Technology & Systems
- Energy Management, Smart Grids

## Study Programmes, Teacher Training





# ForWind Cooperates with Federal Institutions to form the German Research Alliance Wind Energy



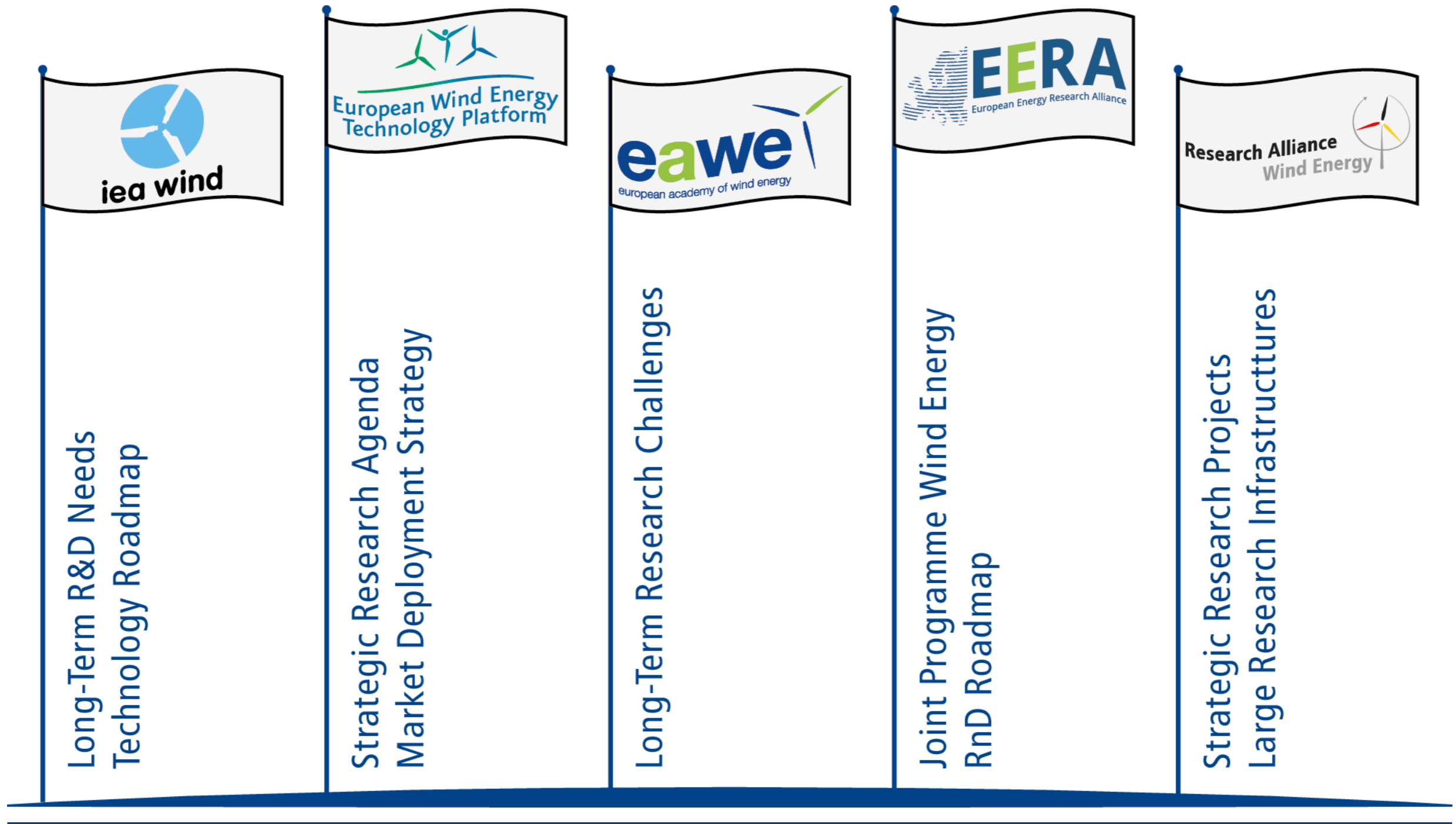
- **ForWind:** 30 institutes at 3 universities in Oldenburg, Hannover, Bremen (state)
- **Fraunhofer** Institute for Wind Energy and Energy System Technology (IWES) (federal)
- **German Aerospace Center (DLR):** 6 institutes (federal)
- **11 locations in 6 German states**
- **~ 600 researchers and staff**
- **Share large research infrastructure**
- **Industry advisory board**

**Research Alliance**  
Wind Energy



[www.forschungsverbund-windenergie.de](http://www.forschungsverbund-windenergie.de)

# Become Visible Among the EU policy bodies: ForWind's contributions to strategic R&D&I roadmaps



# European Academy of Wind Energy

(<http://www.eawe.eu/>)



- **Founded in 2004 as network for exchange of PhD students, today EAWWE**
  - is a registered body of research institutions and universities engaged in Wind Energy research and education with 39 members from 14 countries
  - formulates and executes joint R&D projects and coordinates high quality scientific research and education on wind energy at a European level.
- **Important activities:**
  - Annual PhD seminar
  - Biennial conference: The Science of Making Torque from Wind
  - EAWE supervises Scientific Track of the EWEA Annual Conference
  - Facilitates exchange of staff, PhD & Master students
  - Push the development of high quality standards in Master education and support cooperation



# EAWE's Selection of Programs in Academic Education

- What you find on the website:

## Wind Energy Master Programmes

- Y [\(Erasmus Mundus\) European Wind Energy Master \(EWEM\)](#)
- Y [DTU Wind Energy Master](#)
- Y [Master Programme in Wind Power Project Management](#)
- Y [Offshore und Ocean Technology mit Offshore Renewable Energy](#)
- Y [Wind Energy Engineering](#)

## Extra-occupational | Part Time Study Programmes

- Y [Continuing Studies Programme Offshore Wind Energy](#)
- Y [Weiterbildendes Studium Windenergietechnik und -management](#)

- This list not all-inclusive. There is a large number of other programs.
- Programs vary greatly in scope and address different target groups:  
research  $\Leftrightarrow$  application
- Cooperations on master level have begun just recently .
- EWEM is best-practice in research area.
- ForWind is pioneering with continuing education.
- There are other networks like the Association of European Renewable Energy Research Centres (EUREC).



Part 2

# WIND ENERGY MASTER EDUCATION AT UNIVERSITY OF OLDENBURG/FORWIND

# University of Oldenburg: Over 30 Years of Experience in Teaching Renewable and Wind Energy

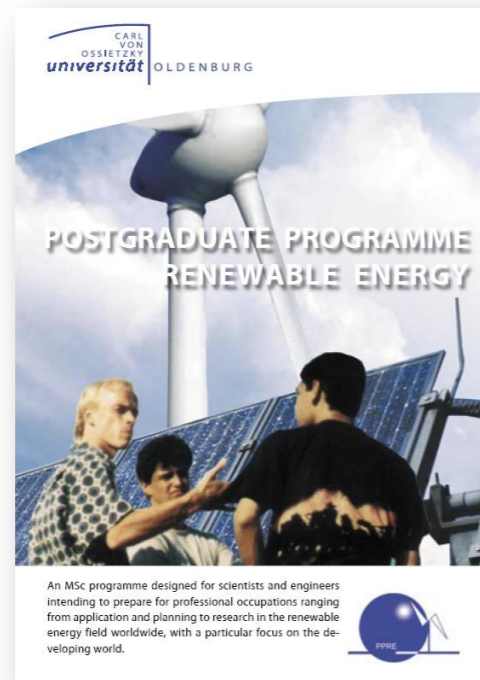
**1980**  
**Physics**  
 BSc / MSc / PhD

**1987**  
**Postgrad. Progr. Renewable Energies (PPRE)**  
 MSc

**2002**  
**European Master in Renewable Energy by EUREC**  
 MSc

**1998 / 2011**  
**Engineering Physics**  
 BSc / MSc / PhD

**2012**  
**EWEM – European Wind Energy Master**  
 MSc



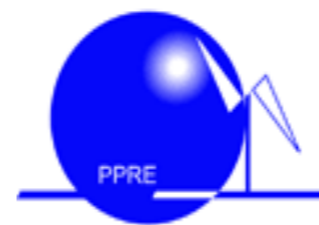
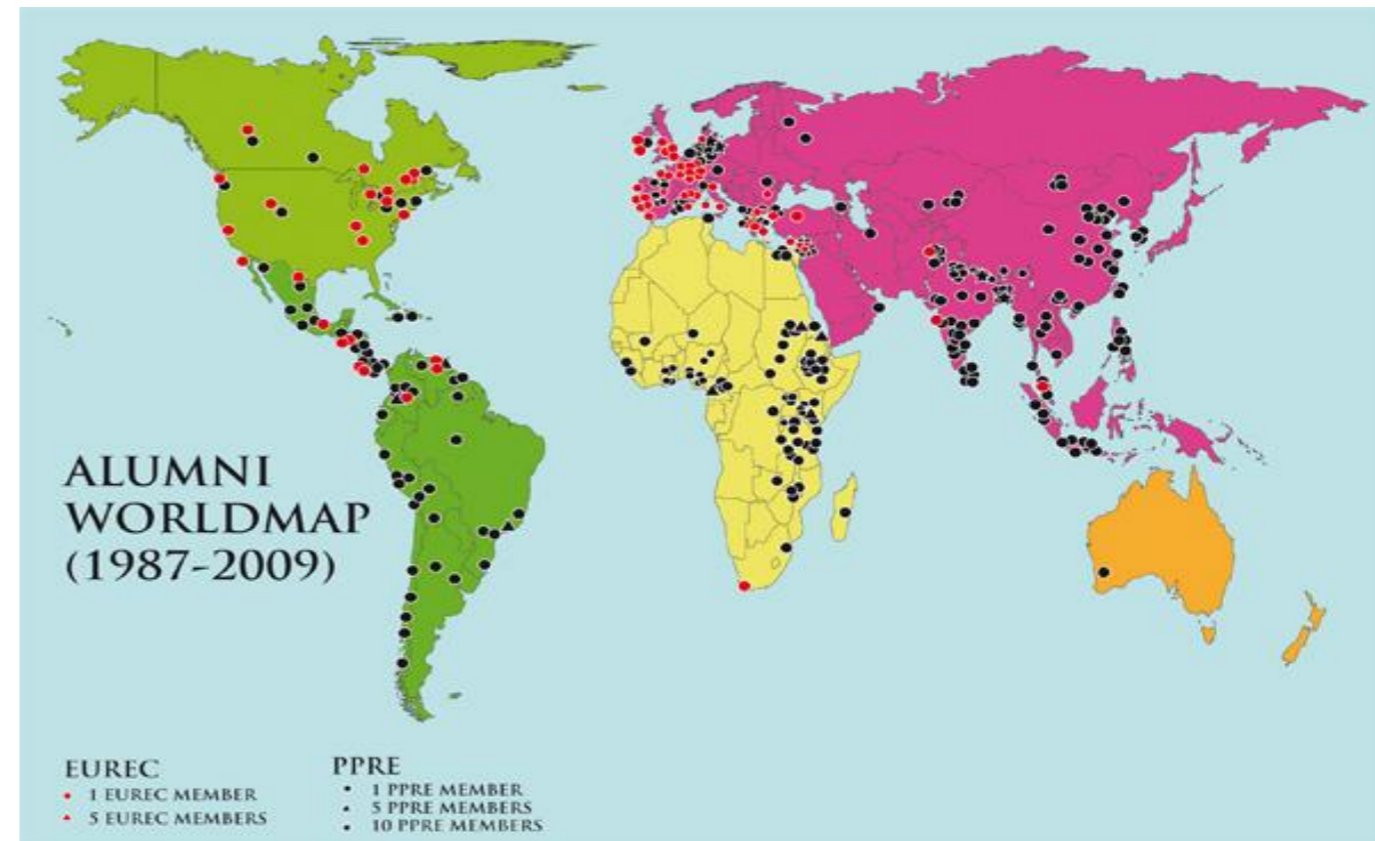
# Number of credits and students per year

Program	ECTS in total / in wind (including master thesis)	Students per year in total / in wind
PPRE	90 / ~30	≤ 40 / ?
EUREC	90 / ~60	≤ 20 / ?
Physics	120 / ?	~ 40 / ?
Engineering Physics	120 / ~108	~ 140 / 40
EWEM	120 / 120	35-40 / 35-40  50% Rotor Design, 25% Offshore Engineering 15% Electrical Power Systems 10% Wind Physics



# Postgraduate Programme Renewable Energy (PPRE)

- Established 1987
- Master of Science
- 3 semester (= 90 ECTS)
- In English
- More than 400 alumni from 79 countries
- Since 2002:  
core semester provider for the  
EUREC-Master in RE
- Wind Energy only one of many  
topics (12 ECTS + thesis)
- Approx. 40 Students per year





# European Master in Renewable Energy



International Master organized by the Association of European Renewable Energy  
Research Centres (EUREC)

3 semesters (90 ECTS):

(1) Core → (2) specialization → (3) Master project



Specializations (30 ECTS)

- Photovoltaics
- Grid Integration
- **Wind power**
- Hybrid systems
- Solar Thermal
- Ocean Energy

Wind Energy: 30 ECTS + master thesis

Approx. 20 students per year



# EUREC-Master Partner Universities



## Core providers:

**Oldenburg University, Germany  
(English)**

Ecole des Mines de Paris, France  
(French)

Loughborough University, UK (English)

University of Zaragoza, Spain –  
(Spanish)

Hanze University of Applied Sciences,  
The Netherlands (English)

## Specialisation Providers:

**National Technical University of  
Athens, Greece - Wind**

Kassel University, Germany - Hybrid  
Systems

University of Northumbria, UK  
– Photovoltaics

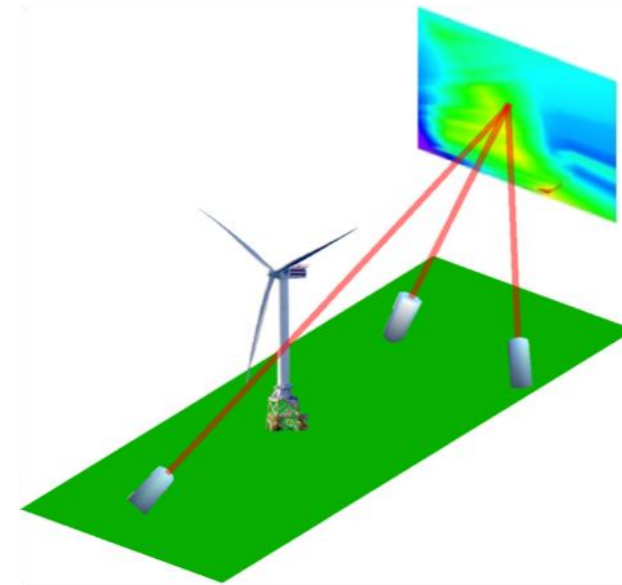
University of Zaragoza, Spain  
- Grid Integration

University of Perpignan, France  
- Solar Thermal

Instituto Superior Tecnico, Portugal  
- Ocean Energy

# Engineering Physics

- In cooperation with University of Applied Science, Emden
- Master of Science in English language.
- 4 semesters / 120 ECTS
- Physics, Mathematics, Engineering Sciences
- Specialisations:
  - Renewable Energies → **Wind Physics**
  - Lasers & Optics
  - Biomedical Physics and Acoustics
- Wind Energy: up to 75 ECTS + thesis
- 140 students per year in program / around 40 in Wind Energy





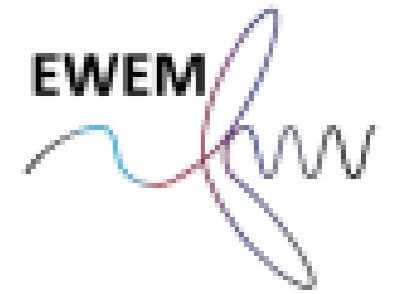


Part 3

# EUROPEAN WIND ENERGY MASTER (EWEM)

# European Wind Energy Master (EWEM)

- 4 world-leading Wind Energy universities join forces
- Building on long-standing cooperation in research and local master programs
- 2 year program, 4 tracks, double degree
- Erasmus Mundus Scholarships for students
- Mobility funding for staff and students
- Associated partners: major industry, business & associations involved: guest lectures, summer schools, internships, or MSc thesis
- Aim: 50-60 graduates per year (today around 40)
- Wind Energy: 90 ECTS + thesis (=100%)



Technical University  
of Denmark





# Program Structure

	<i>First year (60 ects)</i>			<i>Second year (60 ects)</i>	
	Semester 1	Semester 2		Semester 3	Semester 4
Wind Physics	<b>DTU:</b> <i>general introduction to wind energy</i>	UniOl	Summer school	DTU	<b>MSc Thesis:</b> <i>with 2 EWEM partners, and possible participation of industry or other research institute</i>
Rotor Design		TU Delft		DTU	
Electric Power Systems		TU Delft		NTNU	
Offshore Engineering		TU Delft		NTNU	

- TU Delft = Delft University of Technology, DTU = Technical University Denmark, NTNU = Norwegian University of Science and Technology, UniOl = Carl von Ossietzky University of Oldenburg
- 1 ects = 28 hours of study according to the European Credit Transfer System

# Awarded Degrees

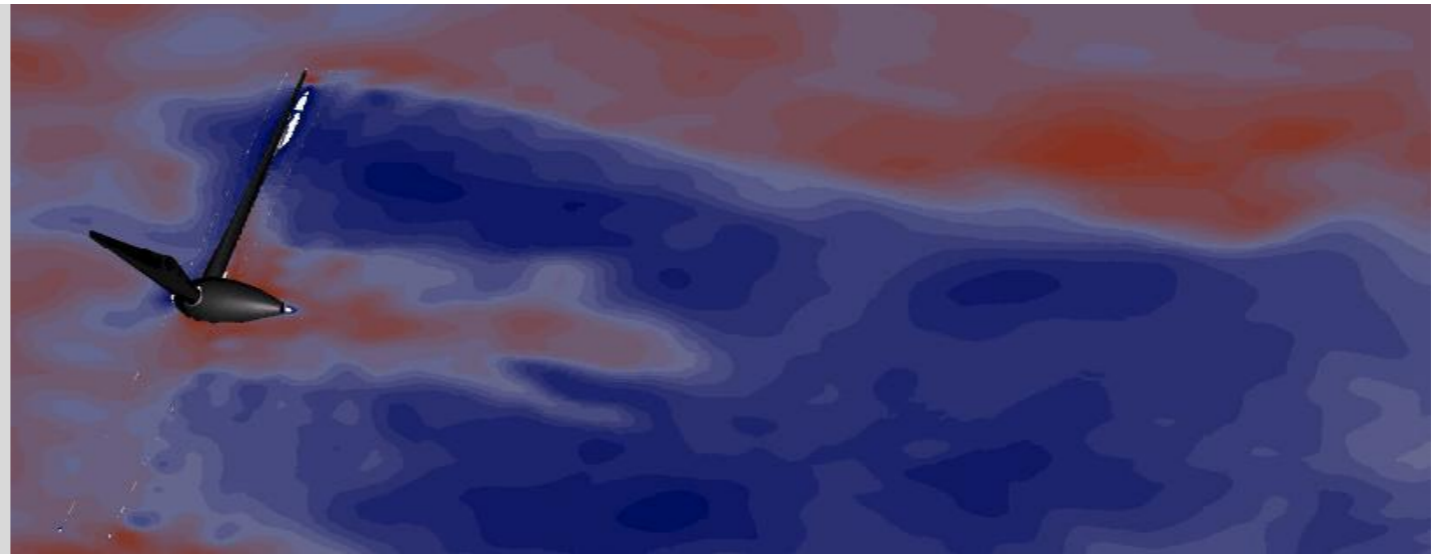
Track	Degree 1	Degree 2
<b>Wind Physics</b>	MSc Wind Energy Engineering from DTU	MSc Engineering Physics from UniOI
<b>Rotor Design</b>	MSc Wind Energy Engineering from DTU	MSc Aerospace Engineering from TU Delft
<b>Electric Power Systems</b>	MSc Electrical Engineering from TU Delft	MSc Technology-Wind Energy from NTNU
<b>Offshore Engineering</b>	MSc Offshore Engineering and Dredging from TU Delft	MSc Technology-Wind Energy from NTNU

# Required BSc Background

1/2

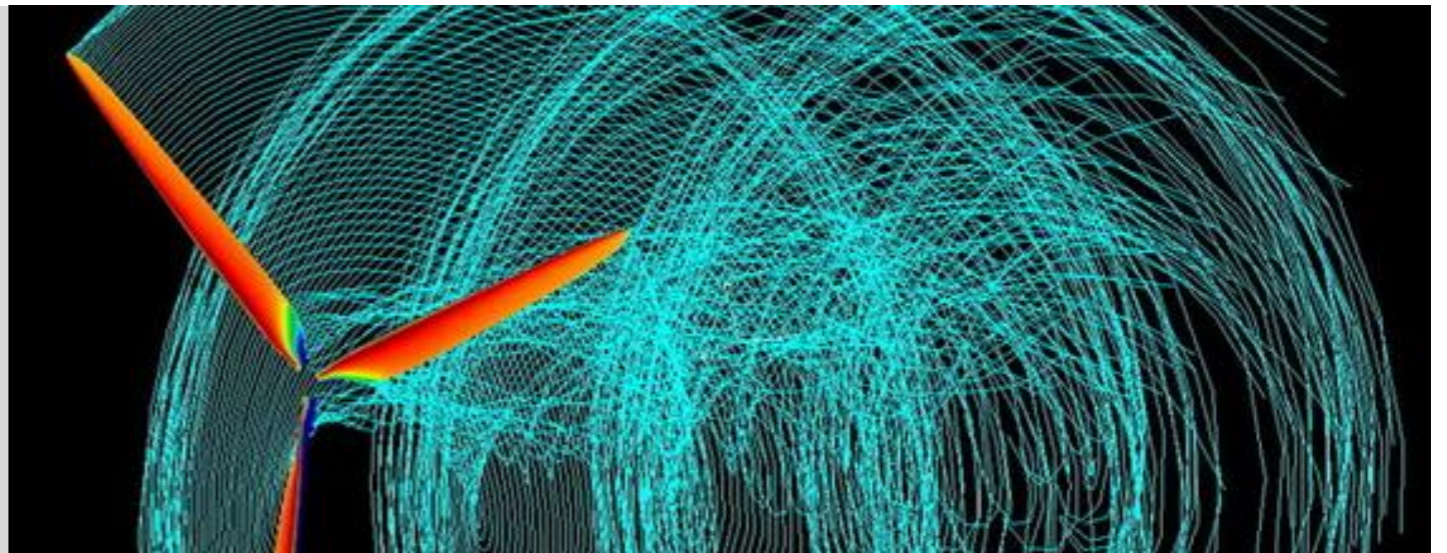
## Wind Physics:

Mechanical Engineering  
Aerospace Engineering  
Mathematics  
Physics



## Rotor Design:

Mechanical Engineering  
Aerospace Engineering  
Physics



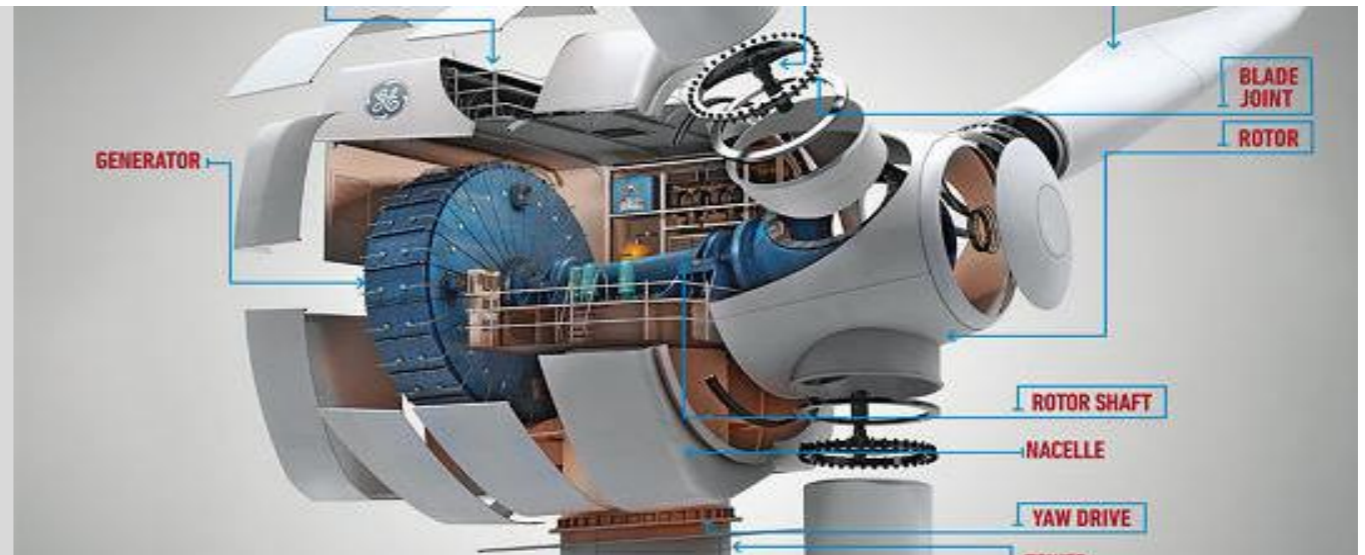
*Similar backgrounds accepted if proven relevant.*



# Required BSc Background

2/2

**Electric Power**  
Systems Electrical  
Engineering  
Physics



**Offshore Engineering**  
Civil Engineering  
Structural Engineering  
Mechanical  
Engineering  
Physics



*Similar backgrounds accepted if proven relevant.*

# Associate Partners





# Associate Partners



SIEMENS

SUZLON

## Opportunities for your engagement within EWEM:

- If you are not associated yet, try to change that.
- Host students for internships or master thesis.
- Host visiting scholars for teaching purposes.
- Use scholarship to travel to one of the four European universities for teaching purposes.
- Give guest lectures at the Summer School.
- Promote PhD and Post-Doc positions.

# Some key issues for successful cooperation in joint programmes -- lessons learned from EWEM:

- Create added value for students: attractive universities and high quality of the program.
- Resources are (as usually) critical: professors, lecturers, staff, rooms,...
- Key issue: local programmes have to be existing beforehand – and they need to fit together without many new courses to be created.
- Collaboration builds on trust that has been developing over the years in research.
- Consortium partners need to overcome local administrative and legal barriers :
  - Different semester calendars / module structure / different credit systems
  - Business model to divide tuition
- Involve industry to fund scholarships (still ways to go on this...).
- Exchange with associated partners can be intensified.



Part 4

# ONLINE CERTIFICATE „ADVANCED WIND ENERGY“ FOR NON-TRADITIONAL STUDENTS

# Motivation:

## Open Universities to Non-Traditional Students

The regular student becomes less regular in Germany:

- 64 % of the students have work experience
- 25% have aquired another job qualification before coming to universtiy
- 66% of the students work part-time
- 79% of those over 30 years work part-time

→ Already, the majority of the students works part-time.

In the future: Number of professionals with Bachelor degree is likely to rise.

And, they are hardly going back to university full-time!



# Online-Certificate Advanced Wind Energy

## Bridge Module

Wind Energy Utilisation 3 ECTS

Fluid Dynamics I 3 ECTS

Computational Fluid Dynamics (CFD) 3 ECTS

## Track I: Energy Meteorology

Energy Meteorology and Numerical Methods for Wind Energy 1 3 ECTS

Energy Meteorology and Numerical Methods for Wind Energy 2 3 ECTS

## Track II: Wind Energy Systems

Design of Wind Energy Systems 3 ECTS

Aeroelastic Simulations of Wind Turbines 3 ECTS

## Extension Module

Measurements and Validation for Advanced Wind Energy (Lab & Field Project) 8 ECTS

$\Sigma$  23 ECTS

# Master online Renewable Energy (MoRE)

90 CP inkl. Brückensemester + 30 CP Master Thesis

Grundlagen  
Modul  
**30**

Kernmodule  
**21**

Fachmodule  
(Wahlpflicht)  
**21 out of 60**

Labormodule  
**6**

Projekt-  
arbeit  
**6**

**Introductory  
Module (0)**

Introduction to  
Online Learning  
Introduction to  
Scientific research  
and writing

**Propäd (30)**

Electricity  
Solid State Physics  
Radiation  
Basic  
Thermodynamics  
Chemistry  
Biology  
Numerics / Simulation  
Basics  
Mathematics /  
Statistics

Wind Energy  
Utilization  
Fluid Dynamics

**En. Systems &  
Thermo-dynamics  
of RE Systems (3)**

ThD od RE  
Systems

**Modellbildung  
(3)**

Modellbildung

**Energy Resources  
& Systems (6)**

Energy  
Meteorology I

Resources,  
Distribution &  
Systems

**Energy, Society &  
Ecology (9)**

Renewable  
Energy & Society

Sustainability of  
RE Technology

**Energy Economics**

**Fachmodule 7 out of all (21 CP)**

Solar Energy  
Meteorology

PV Systems I

Semiconductor I

Biomass Energy /  
Resource

Micro Hydro

Rural Energy I

Sol. Thermal Systems I

Wind Energy Meteo-  
rology I

Design of Wind Energy  
Systems

Secondary Batteries  
(Basics)

Applications for  
Electrical Storage  
Systems

Fuel Cell I

PV Systems II

Semiconductor II

Biomass Conv.  
Technologies

Rural Energy II

Sol. Thermal Systems II

Wind Energy Meteo-  
rology II

Aeroelastic Simul of  
Wind Turbines

Grid Integration and  
Charge Control

**Labormodul I (3)**

Labs: RE  
components and  
Energy Transfer  
Mech. (3)

Introd. to Lab  
Work

**Labormodul II**

Labs: RE Systems  
(3)

Datalogger

**Project Work  
(10)**

Case Study (4)

Management  
(2)

Financing (2)

**Software(2)**

**Modul  
Internship**

**6**

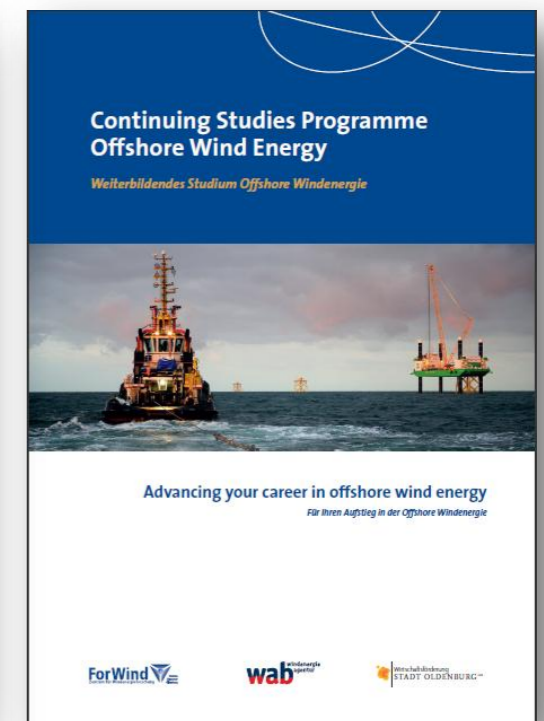
**Internship  
(6)**

rot: Lehrveranstaltungen ForWind,  
blau: Next Energy  
grün: IÖB



mandatory, on-site U OI  
mandatory, online  
elective, online  
elective, free choice

**Onshore 2006**

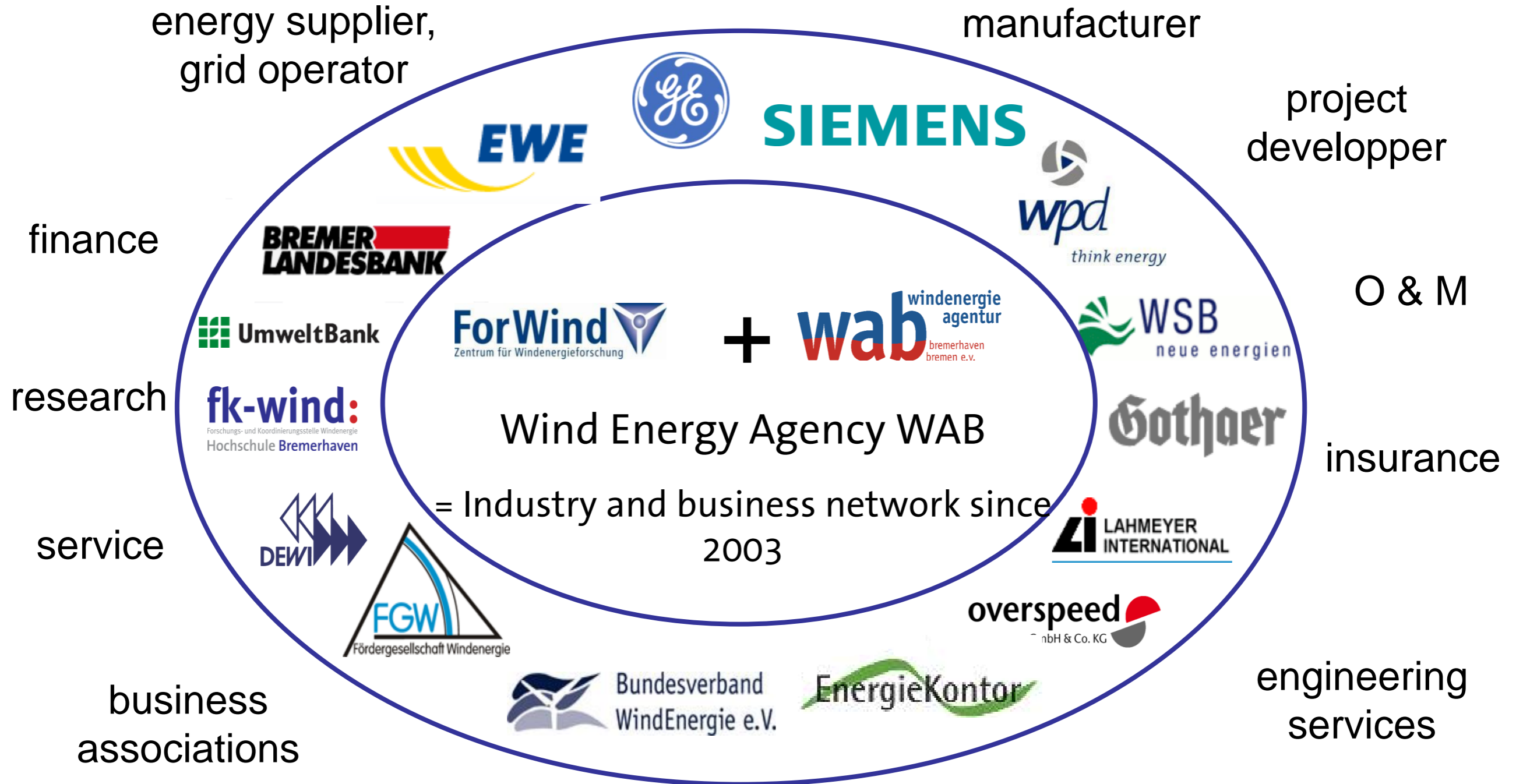


**Offshore 2012**

Part 4

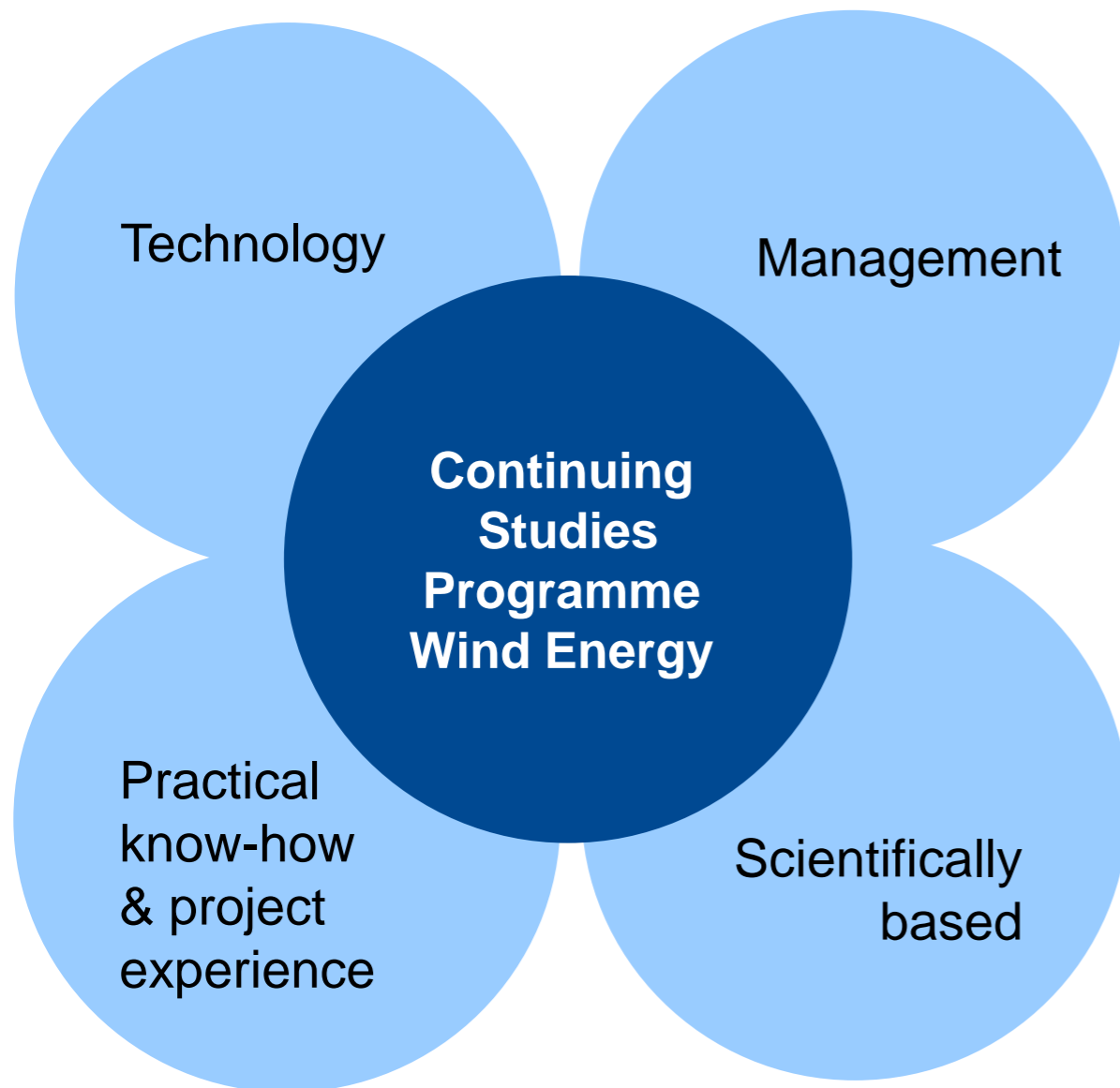
# CONTINUING EDUCATION FOR PROFESSIONALS IN WIND ENERGY

# 10 Years of Collaboration with the Wind Energy Industry





# Participants and Lecturers built Network of Experts in Realization and Operation of Wind Farms



- **Multi-disciplinary target group:**
  - scientists, engineers, project developers,
  - economists, managers, law, finance, insurance,...
- **Lecturers** are experts from industry, business, and universities.
- **Aims:**
  - Offer systematic know-how about wind energy projects.
  - Fill individual knowledge gaps.
  - Develop **interdisciplinary competences**.
  - Build **network** of experts.
- **Leadership program.**

# Interdisciplinarity and Systems Knowledge

Understand and Master the Complexity of  
Modern Wind Farm Projects

Science, Technology

Law, Policy, Economy

Planning, Development

Financing, Insurance

Manufacturing,  
Components

Logistics, Construction

Technical and Commercial  
Operation

Maritime Technologies

# Example: Participants of the Continuing Studies Program in Offshore Wind by Areas of Supply Chain



# Structure and Organisation

- **Part-time study program for and with professionals**
  - Duration: 11 months
  - University certificate on Master level (30 ECTS)
  - Fee: 9.200 EUR
- **Mix of methods / „blended learning“:**
  - Lecturers from industry, business, universities.
  - Exclusive reading material (3-4 weeks reading period)
  - On-site seminars once a month
  - Project work (wind farm development)
  - Field trips, workshops, ...
  - Online learning platform
- **Alumni network** with more than 220 alumni and 80 lecturers





# The Key Learning Experience: Develop a Wind Farm in Interdisciplinary Project Teams

## Task: Wind Farm Development

- Interdisciplinary teams form virtual company
- Project meetings during on-site lectures
- Support through online-platform
- Project presentation is main part of final exam



## Learning by doing:

- Learn all aspects of wind farm development
- Gain experience in project and team management
- Train communication and negotiation skills



# CONCLUDING REMARKS

# Conclusion

- There are many good examples for educational activities in Europe. EAWE started as network for PhD students but is now supporting exchange about curricula on Master level.
- EWEM is best-practice model.
- Collaboration among universities is wanted in Europe. There are a lot of organisational and administrative challenges. Personal connections are key!
- Education of non-traditional students is becoming more important: Continuing online and part-time programs offer new chances. Collaboration with industry is important – and in return also helps to extend the network for researchers.
- Future challenges in the energy transition (innovation in systems technologies for grid stabilisation, smart grids, or new market instruments) will lead to changes in the programs.

➔ We are looking forward to collaborating with you !



# Thank You! Questions?

**Collaboration wanted!**

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**[www.windenergymaster.eu](http://www.windenergymaster.eu)  
[www.windstudium.de](http://www.windstudium.de)  
[www.offshore-wind-studies.com](http://www.offshore-wind-studies.com)**