RAVE
RESEARCH AT ALPHA VENTUS

RAVE offers its 10 years of measurement data for research

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Fraunhofer Institute for Wind Energy Systems IWES

Supported by:

Federal Ministry
for Economic Affairs
and Energy

on the basis of a decision
by the German Bundestag

Supervised by:

ptJ
Projektträger Jülich
Forschungszentrum Jülich

Co-ordinated by:

Fraunhofer
IWES

Outline

- Research at alpha ventus
- Measurements at alpha ventus
- RAVE data and data access

Offshore test field alpha ventus

Fraunhofer IWES

RAVE
RESEARCH AT ALPHA VENTUS

RAVE – Research at alpha ventus

- Funded by the Federal Ministry for Economic Affairs and Energy (BMWi)
- Accompanying research at the alpha ventus test site
- 35 R&D projects, +60 project partners
- +50 mill. € support
- Running since 2007, new phase ‚OpenRAVE' 2020-2025

RAVE – Steering Committee :

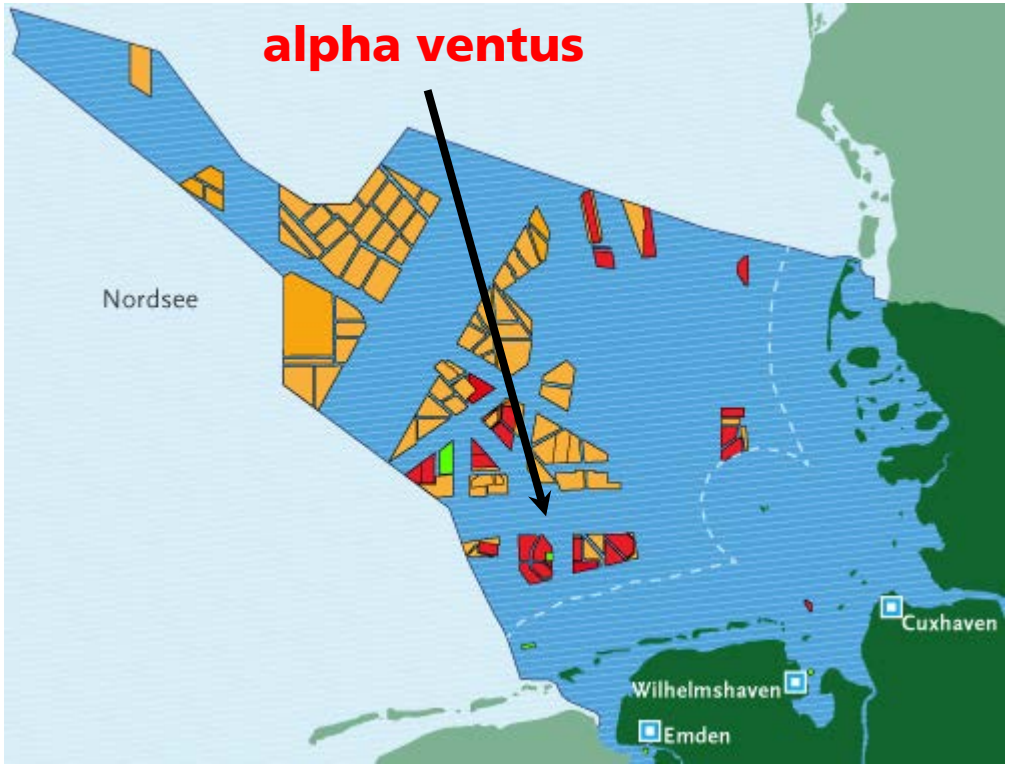

Bundesministerium für Wirtschaft und Energie
alpha ventus
MARTIN-LUTHER UNIVERSITÄT HALLE-WITTENBERG
itap
Hochschule Magdeburg • Stendal
Fraunhofer IWES
AWI Alfred-Wegener-Institut für Polar- und Meeresforschung in der Helmholtz-Gemeinschaft
RWTH AACHEN UNIVERSITY
Deutsches Meeresmuseum
Hochschule Bremerhaven
ptj Projektträger Jülich Forschungszentrum Jülich
Universität Stuttgart
KARL WREDE Stahl- und Maschinenbau GmbH
Deutscher Wetterdienst
DNV·GL
MENCK
ForWind Zentrum für Windenergieforschung
offshore forum windenergie
IZP
BIBA
DEWI
OFFIS INSTITUTE FOR INFORMATION TECHNOLOGY
FGW renewable energies
Bio Consult SH
FACHHOCHSCHULE KIEL University of Applied Sciences
Forschungs- und Entwicklungszentrum Fachhochschule Kiel GmbH
CARL VON OSSIETZKY universität OLDENBURG
UNIVERSITÄT DUISBURG ESSEN
STIFTUNG OFFSHORE WINDENERGIE
AvEC Research
BTC
FH FLENSBURG
FINO 1 2 3
BSH BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE
DLR Deutsches Zentrum für Luft- und Raumfahrt in der Helmholtz-Gemeinschaft
IfAÖ
berlin
KIT Karlsruhe Institute of Technology
WEPROG
UNIKASSEL VERSITÄT
Universität Bremen
Leibniz Universität Hannover
HYDROTECHNIK LÜBECK PROTECTING ALL MARINE LIFE FORMS
OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG
FORSCHUNGS- UND TECHNOLOGIEZENTRUM WESTKÜSTE BÜSUM
TUM LAREG
AREVA
AREVA Wind
THALES
BAM
SENVION wind energy solutions
RAVE RESEARCH AT ALPHA VENTUS

Offshore test field alpha ventus

First German offshore wind farm

- 12 turbines
- Distance to coast: 60 km
- Water depth: 30 m
- Erected 2009

www.alpha-ventus.de



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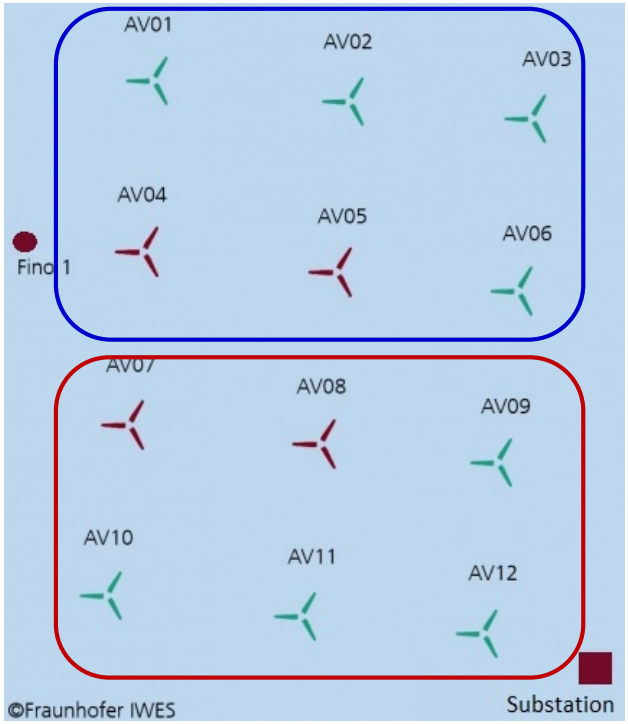
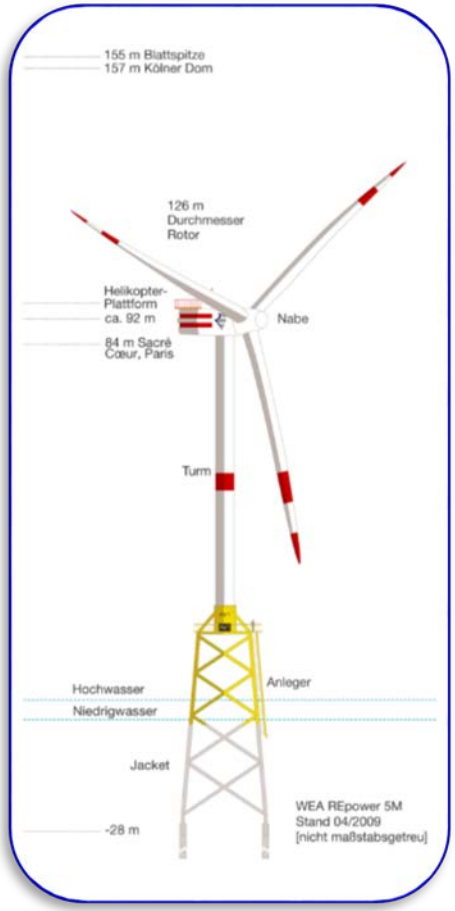
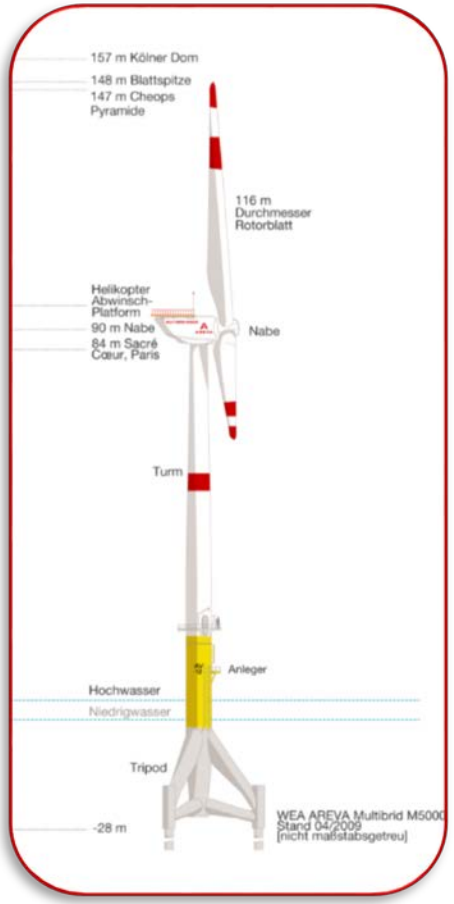
Layout of alpha ventus

Senvion 5M



AREVA Wind M5000





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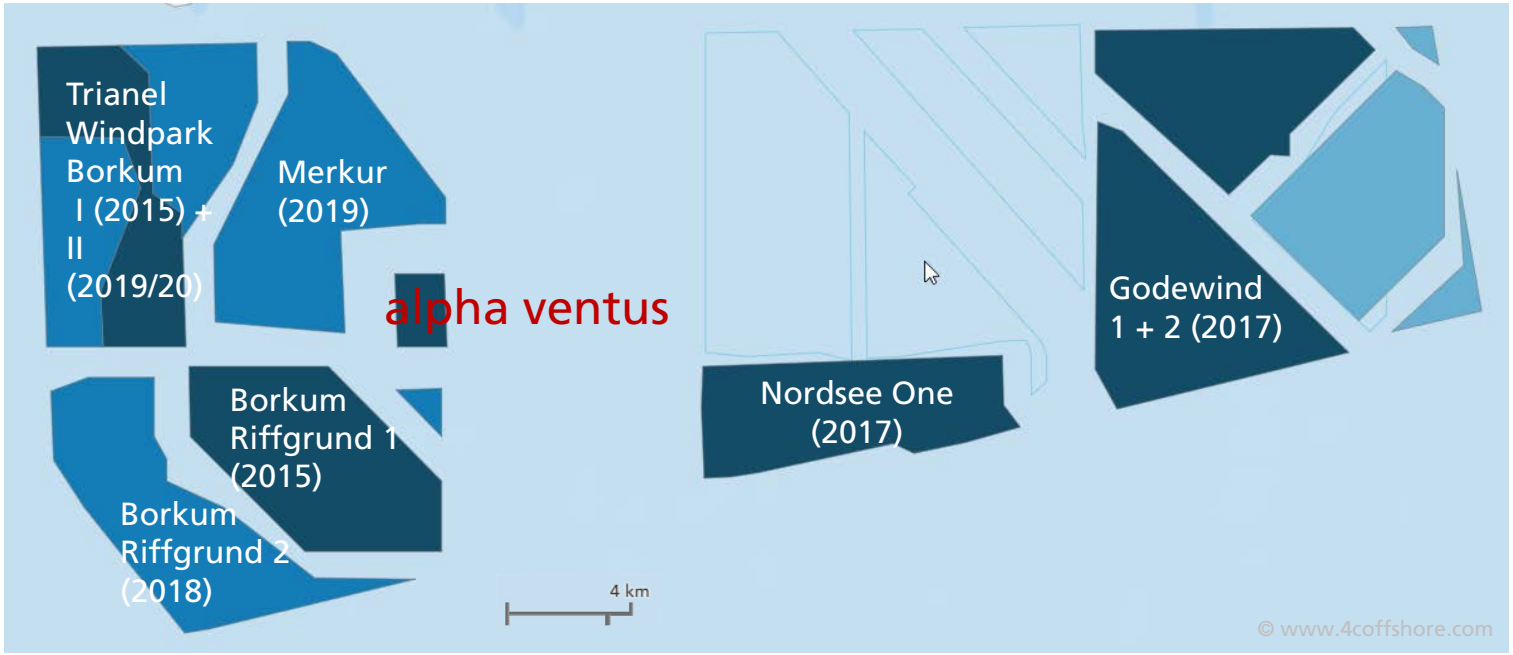
Wind farms close to alpha ventus



RAVE Research Topics

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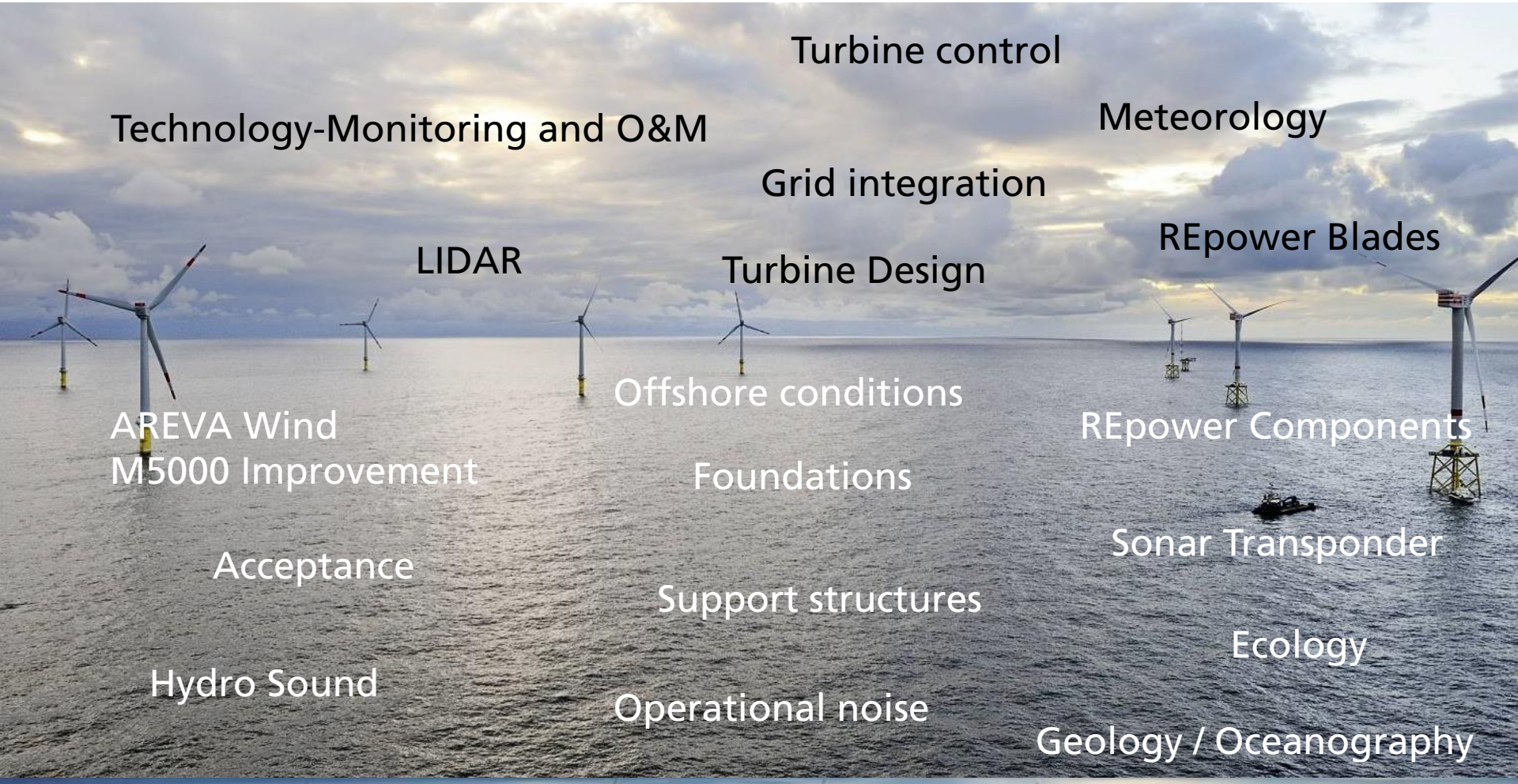

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Measurement service project

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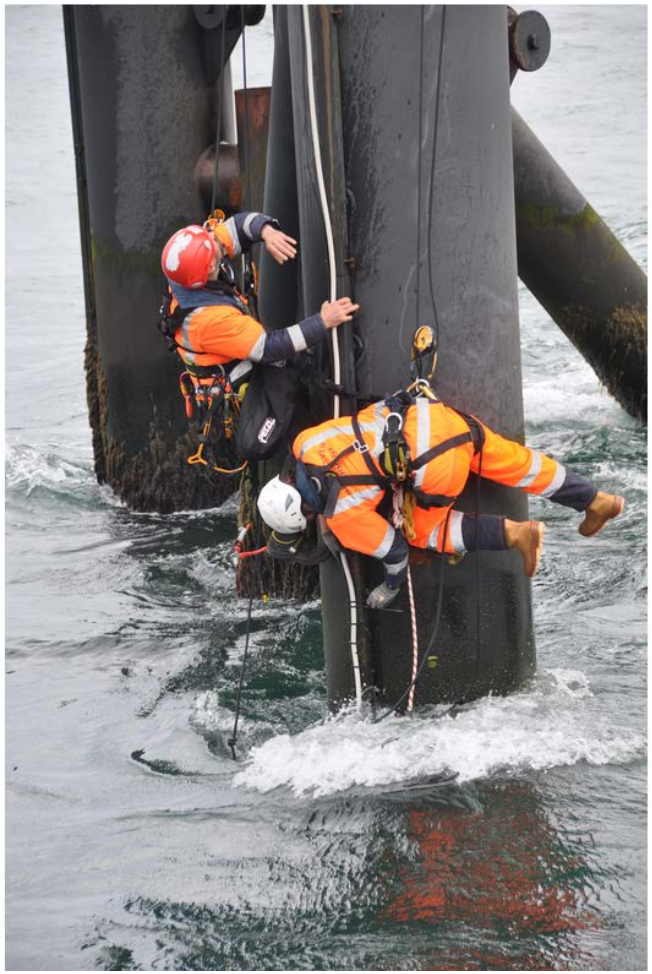
- All measurements needed in RAVE projects are combined in a seperate project
- Co-ordinated by the German Federal Maritime and Hydrographic Agency
- Measurements performed by UL international and DNV-GL
- Installation, operation and maintenence of sensors and measurement systems
- Logistics of offshore operations
- Data transport, processing and storage in the RAVE data base



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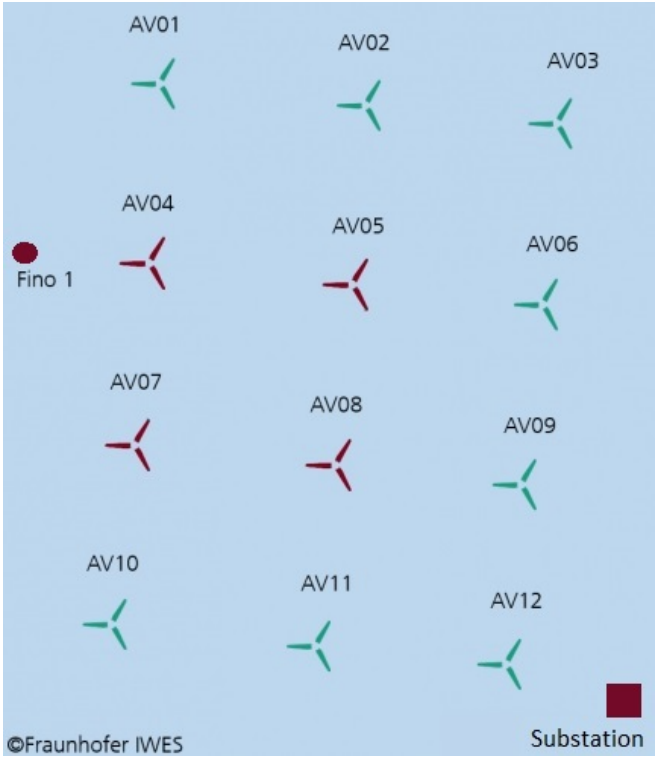
RAVE RESEARCH AT ALPHA VENTUS

RAVE measurements

- 4 turbines instrumented
- 100m met mast Fino 1 in direct vicinity
- Oceanographic measurements at different locations
- Electrical measurements on offshore and onshore substations
- SCADA and turbine controller data
- Special measurements (Noise,…)

- up to10 years time series… ongoing



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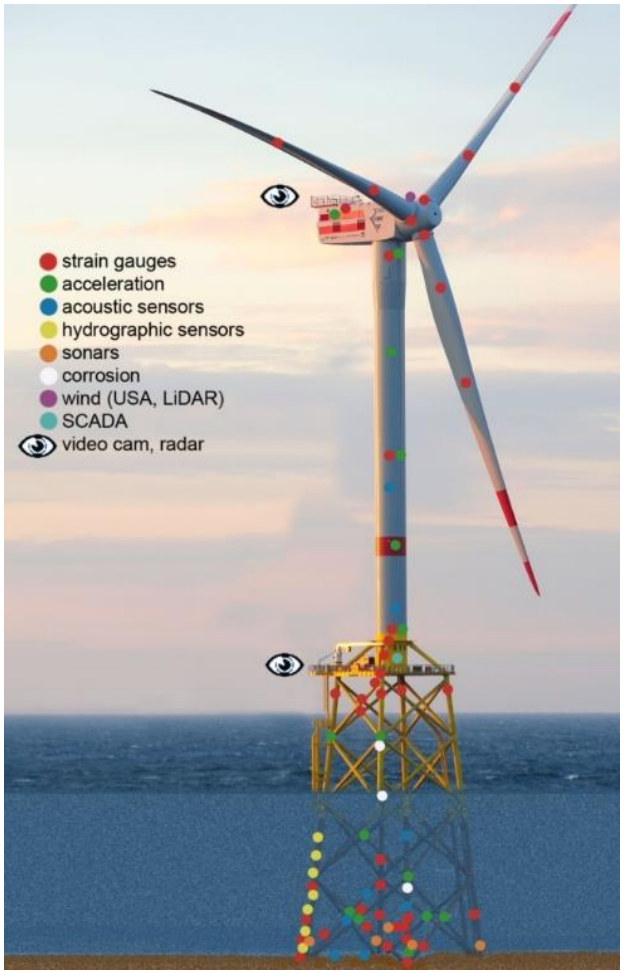
Senvion 5M



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- strain gauges
- acceleration
- acoustic sensors
- hydrographic sensors
- sonars
- SCADA
- video cam, radar

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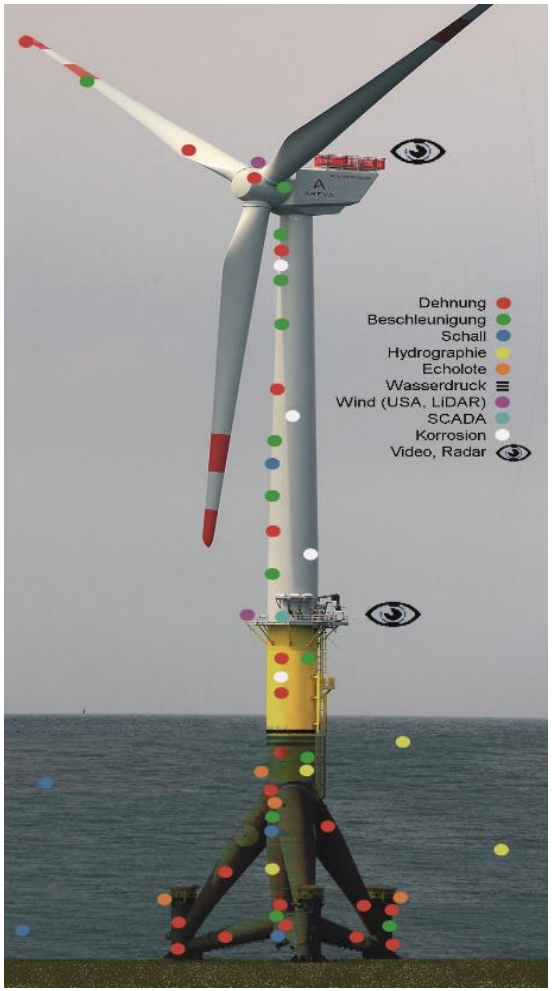
Adven M5000



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- strain gauges
- acceleration
- acoustic sensors
- hydrographic sensors
- met data (sonic, lidar)
- sonars
- water pressure sensors
- SCADA
- corrosion
- video cam, radar

RAVE RESEARCH AT ALPHA VENTUS

Substations onshore / offshore

- Measurements of currents and voltage
- At both onshore and offshore substation
- High resolution
- Years of data

Meteorological and oceanographic measurements

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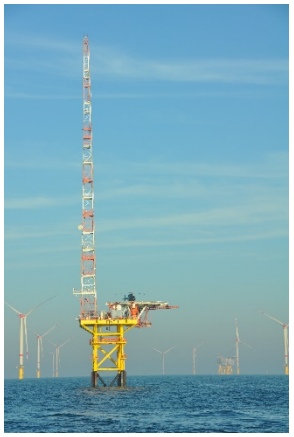
Meteorological mast Fino 1 (seperate project)

- Wind, temperature, humidity,… up to 100m height
- Ultrasonics
- Waves, currents, …



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Oceanography

- Waves
- Current profiles
- Temperature profiles

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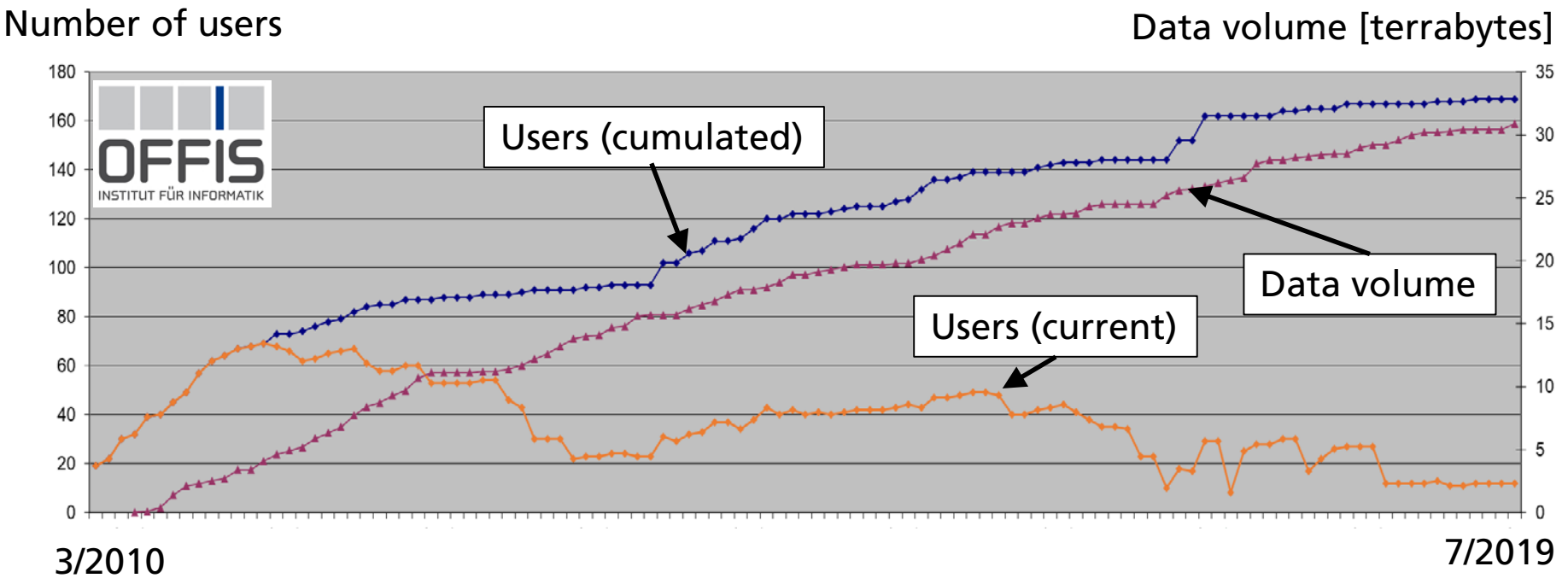
RAVE data base

- Tha data is stored in a data base
- Maintained by BSH (up to 2019 Offis)



Data access

- RAVE data is funded by the German government with the aim to support the development of offshore wind through research
- Data access procedure has been changed 2019, data accessibility greatly improved
- However, data is confidential:
  - a standard data usage agreement has to be signed (available on homepage)
  - Exception: Access to high resolution data from turbine controllers require bilateral agreement with manufctorers
- New project ‚OpenRAVE' (2020-2025) support use of data

Conclusion

- RAVE is an essential cornerstone in the development of offshore wind energy in Germany
- alpha ventus and RAVE are used as blueprint for offshore wind power demonstration worldwide
- Co-ordinated and cross-linked research can be used as prototype for other large research initiatives
- RAVE has collected a long-term and unique data set of in-situ measurements
  - 10 years of data
  - Extensive instrumentation of 4 turbines
  - 100m met mast
- Most of the data are easily accessible for research

Information on data and data access…

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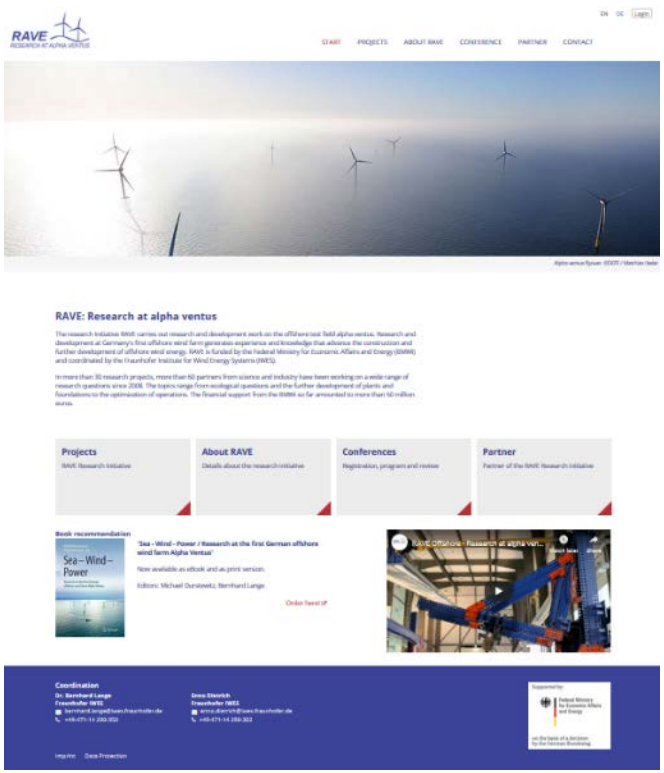
Flyer about RAVE data

RAVE Homepage:
www.rave-offshore.de

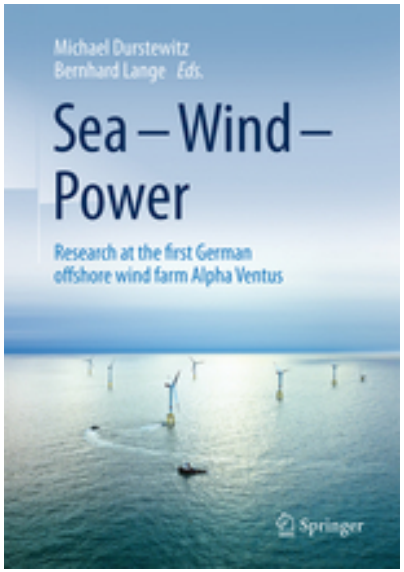
More information about RAVE…

RAVE Homepage:
www.rave-offshore.de



RAVE video:
DVD and youtube

RAVE book (Springer):
Sea – Wind - Power



Offshore wind R&D conferences
2012, 2015 and 2018

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Thank you…

Fraunhofer IWES

…to the BMWi for the funding of RAVE:

Federal Ministry
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on the basis of a decision
by the German Bundestag

… and to you for your attention!

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