

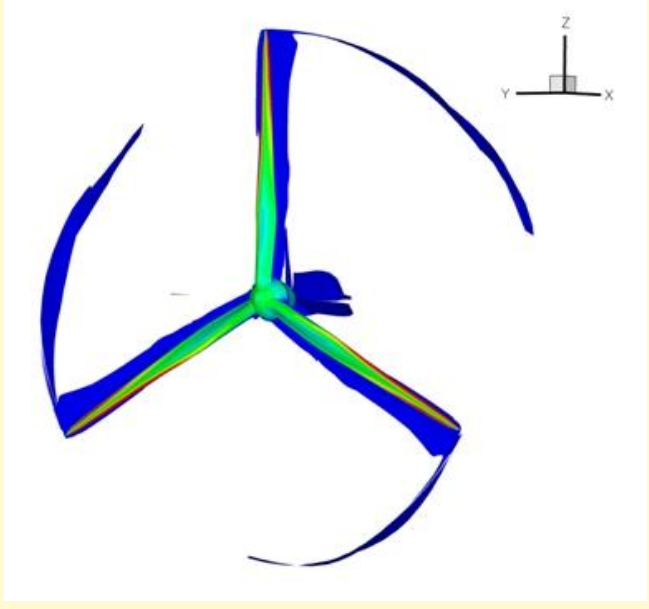
RAVE - A MILESTONE IN OFFSHORE WIND ENERGY RESEARCH

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Turbine Technology and Monitoring



RAVE – REpower Components
Further development of offshore wind turbine components with respects to costs, longevity and servicing conditions.
REpower Systems SE



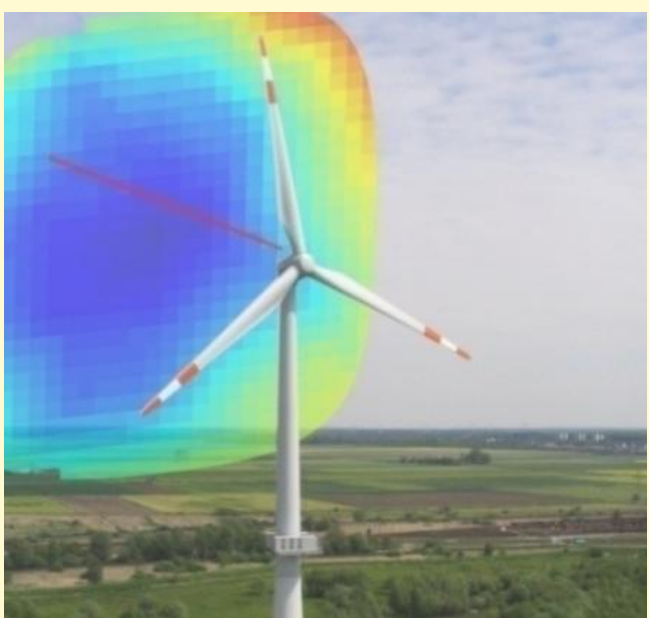
RAVE – OWEA
Verification of offshore wind turbine technology with focus on atmospheric conditions, turbine behavior and load cases in offshore environment.
ForWind – University of Oldenburg



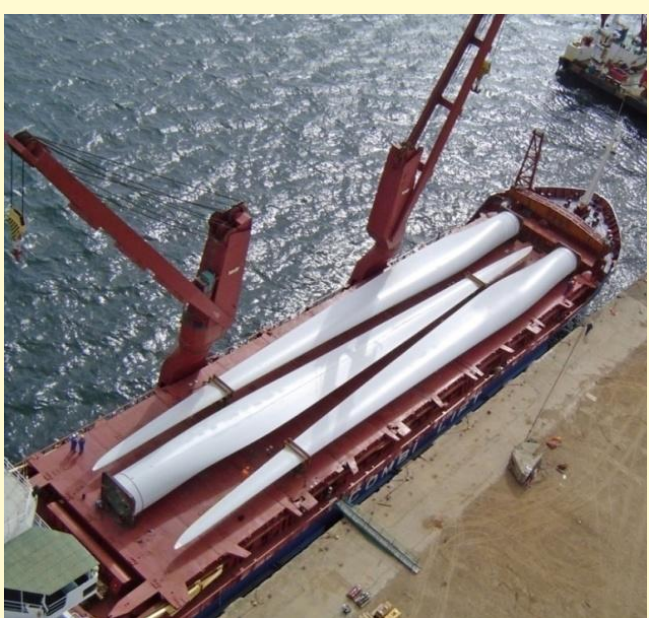
RAVE–AREVA Wind M5000 Improvement
Further development, construction and testing of the M5000 wind turbine under offshore conditions.
AREVA Wind GmbH



RAVE – Offshore-WMEP
Monitoring of the offshore wind energy deployment in Germany with focus on energy production, availability, service concepts, external conditions etc.
Fraunhofer IWES



RAVE – LiDAR
Further development of LiDAR wind measuring techniques for offshore applications.
ForWind – University of Oldenburg



RAVE – REpower Blades
Development of an innovative, performance-optimized and cost-efficient rotor blade for offshore wind turbines.
REpower Systems SE



RAVE – UFO
Measurement and analysis of climatological environmental parameter and their influence on components of wind energy turbines.
Hochschule Bremerhaven fk-wind



RAVE – TUFFO
Investigation of the impact of turbulent moisture fluxes on the turbulence in the marine boundary layer.
Karlsruhe Institute of Technology (KIT)

Grid Integration



RAVE – Grid Integration
Development of strategies and tools for the effective integration of offshore wind power into the electricity supply system.
Fraunhofer IWES

OVERVIEW

The RAVE research initiative is accompanying the construction and operation of the alpha ventus test site to attain a broad basis of experience and expertise for future offshore wind parks.

Several research projects are currently carried out. They focus on

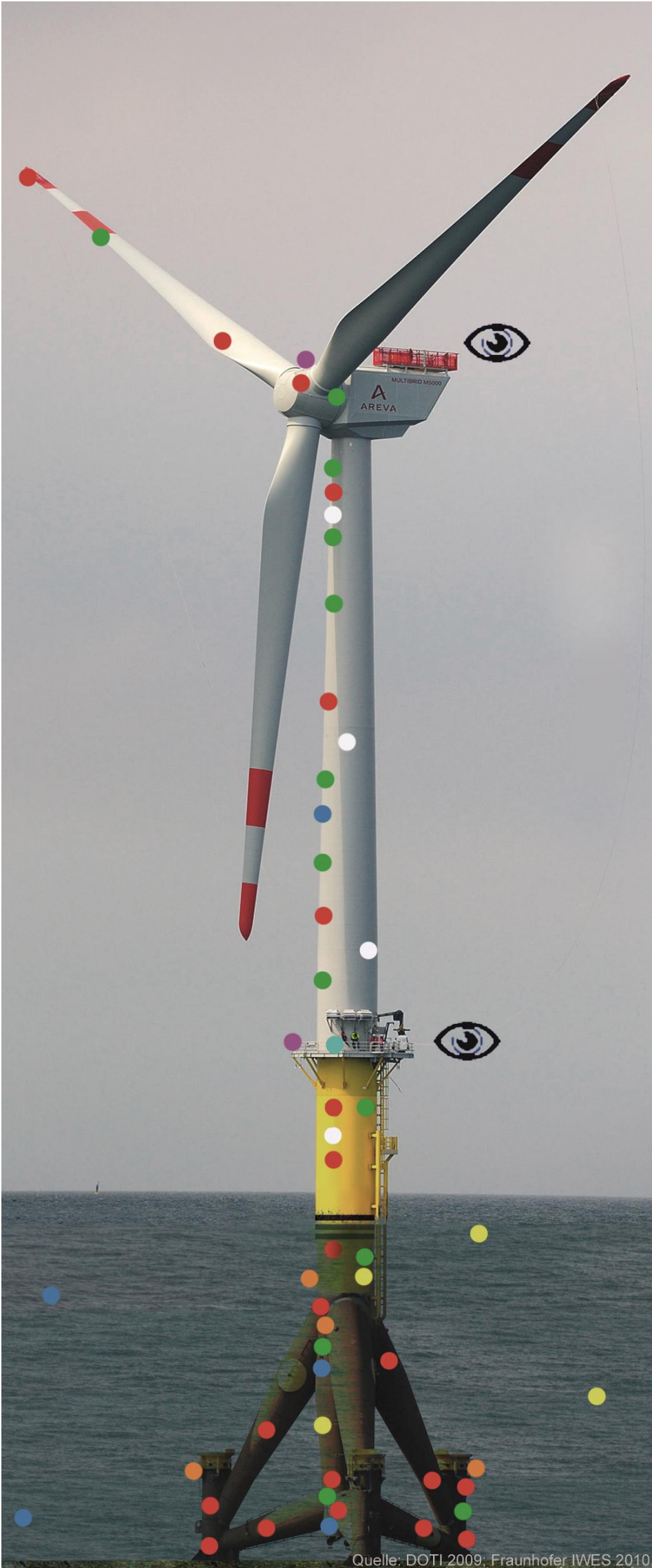
- cost reduction,
- availability,
- technology improvement,
- environmental and ecological impacts

of offshore wind energy utilization.

In addition to approximately 25 individual RAVE research projects there are two complementary cross-sectional projects: the RAVE Coordination Project, and the RAVE Measurement Service Project. The objective of the RAVE Coordination Project is to network all individual RAVE projects, to represent them and to achieve the structure for an efficient joint program.

RAVE INSTRUMENTATION & DATA

For the research projects comprehensive measuring data are indispensable. The RAVE Measurement Service Project has the goal to carry out measurements and to coordinate the data demand of the individual RAVE projects as a service for all involved institutes, authorities and companies. Load conditions, operation sounds, noise immission during the wind turbine setup phase, oceanographic and geological data are the main measurement parameters.



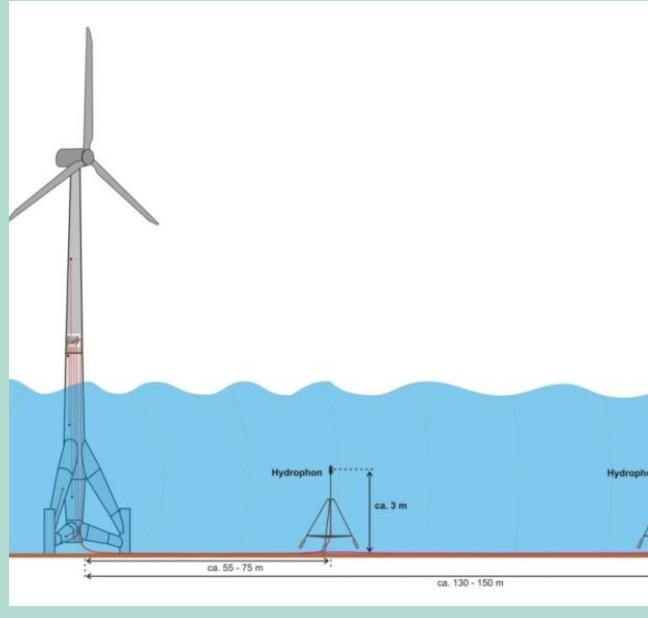
- Strain gauges
- Acceleration
- Acoustic sensors
- Hydrographic sensors
- Sonars
- Water pressure
- Met data (USA, LiDAR)
- SCADA
- Corrosion
- Video cam, radar

Sketch of AREVA Wind M5000 (AV7) offshore wind turbine in the alpha ventus test field. Markings on the structure and in the water indicate locations and type of instrumentation used for the RAVE measurements.

Additional sensors are installed on AV8 (AREVA Wind M5000), AV4 and AV5 (REpower 5M), on the alpha ventus transformer platform, the onshore transformer station, and at various other positions in the waters of the alpha ventus test field.

Data from a total of about 1,200 measuring points are recorded and processed and are available to accredited researchers in the RAVE data base.

Environment



RAVE – Operational Noise
Assessment of the operational underwater sound immission of offshore wind turbines under varying boundary conditions.
Flensburg University of Applied Sciences



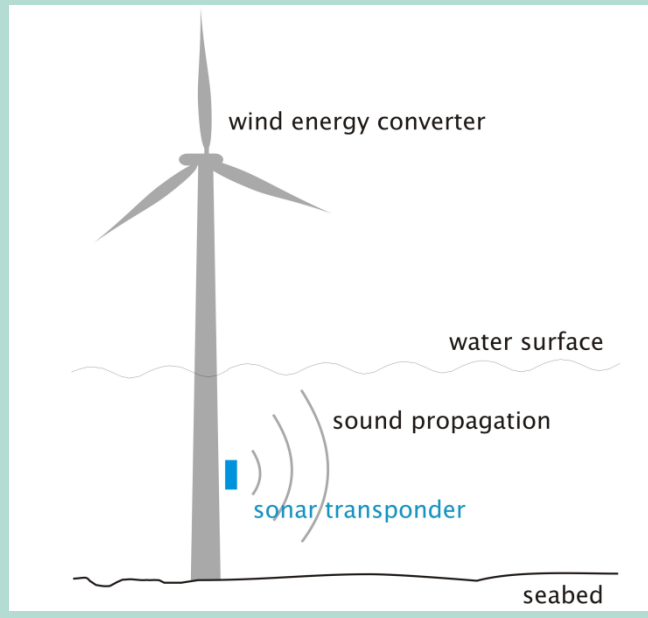
RAVE – Ecology
Research on the impact of offshore wind parks on marine environment and evaluation of BSH's Standard for Environmental Impact Assessments.
BSH – Federal Maritime and Hydrographic Agency



RAVE – Acceptance
Assessment of the social acceptance of offshore wind energy utilization by residents and tourists in four coastal regions on the North and Baltic Sea.
Martin Luther University Halle Wittenberg



RAVE – Hydro Sound
Evaluation of sound reduction measures to minimize impacts on the marine environment.
Leibniz Universität Hannover – ForWind

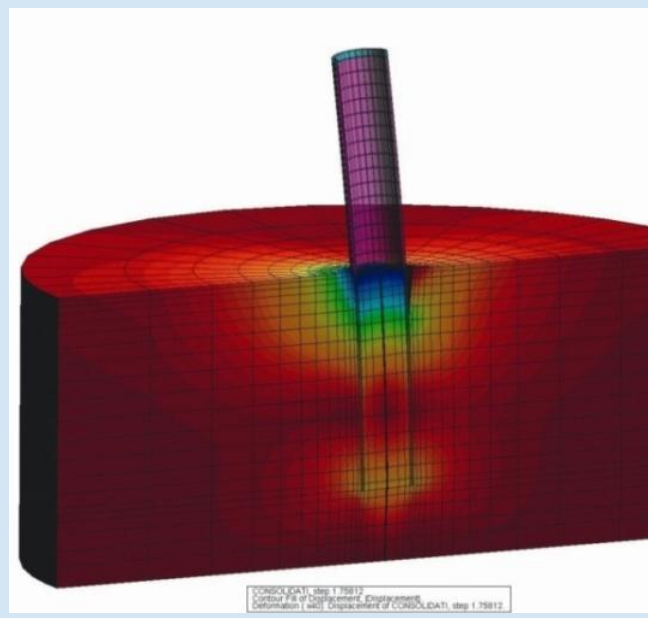


RAVE – Sonar Transponder
Investigation of sonar transponders for offshore wind farms as acoustic warning systems to submarines and integration into an overall technical concept.
Leibniz Universität Hannover – ForWind

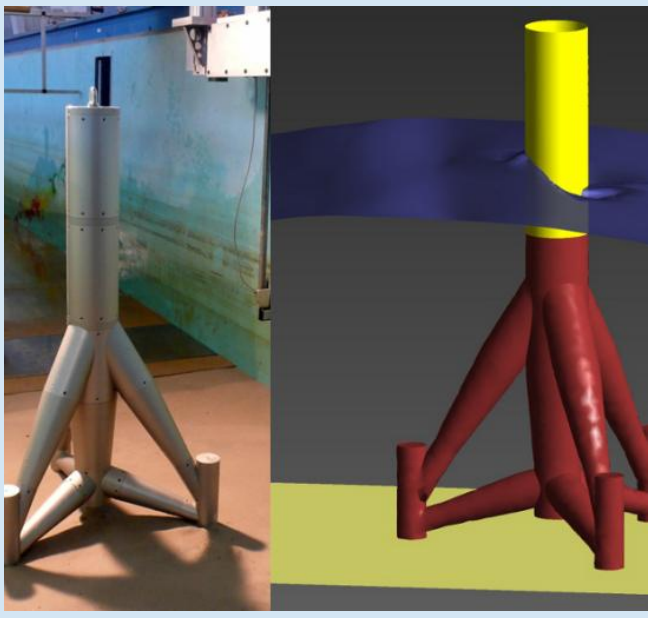


RAVE – Geology / Oceanography
Analyzing impacts of offshore wind farms to the marine environment.
BSH – Federal Maritime and Hydrographic Agency

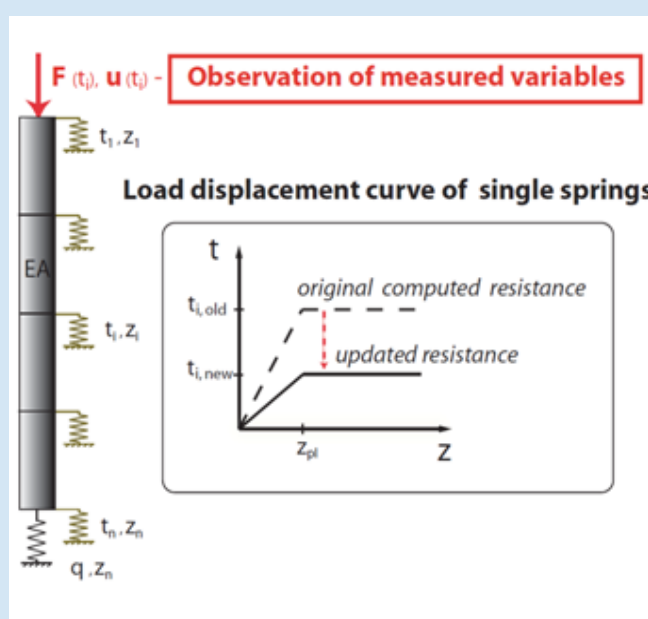
Foundation and Support Structures



RAVE – Foundations
A practical design and monitoring procedure for foundations of offshore wind turbines under cyclic loads.
BAM - Federal Institute for Materials Research and Testing



RAVE – GIGAWIND alpha ventus
Holistic design concept for offshore wind turbine support structures based on measurements at the offshore test site alpha ventus
Leibniz Universität Hannover – ForWind



RAVE – Foundations Plus
Research and Testing Procedures for foundation monitoring and data evaluation suitable for offshore wind turbines
BAM - Federal Institute for Materials Research and Testing