

# **Department Annual Report 2017**

Department of Wind Energy

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## 1. Introduction

### 1.1 Brief summary of the most significant results in 2017

2017 has been another good year for the department with good research results, increased intake of students for the MSc-programs, successful launch of the e-learning continued education master of wind energy, increased work with industry and a Global Wind Atlas 2.0 as the most visible result of our scientific advice. The financial results are better than expected, with a substantial increase in the income from national and international research and innovation programs as well as rising income from commissioned research, testing etc. This is a clear indication of the quality and relevance of our research for the wind energy sector. However, it has also been a year with strategic adjustments, implying i.e. an enhanced focus on the strategic development of the strategic research and innovation programs, internal synergy and impact, leading to the closure of the Section for Material Research and Characterization. Internal processes are continually being developed and adjusted, and in 2016 and 2017 the department has worked intensively with re-organizing and re-adjusting the focus of the administration, research support and communication efforts.

Overall, the department is both efficient and effective in its operation, but adjustments and initiatives to further develop will continue in areas like;

- Renewal and scientific development of the research within wind energy
- Continue to attract more external funding of the research
- Collaboration and alignment of the research between geographically separated groups
- Recruitment of managers and researchers
- Succession management

#### *Education and teaching:*

DTU Wind Energy performs education and training in wind energy related disciplines and offers now 16 MSc courses, three Bachelor courses and three PhD courses every year. In 2017, 60 MSc thesis students finished their education at DTU Wind Energy. Furthermore, 58 students were accepted at the Master of Wind Energy (MScWE) in 2017 and additionally 31 students were accepted at the Master in Sustainable Energy (MScSE). Compared to the year before (2016), where there were 43 MScWE students and 27 MScSE students, 2017 has shown significant improvement.

The department launched a new online, continued education master's program in Wind Energy, offering individuals around the world a new and unique opportunity to take a web-based master's degree in wind energy. 33 participants from all over the world signed up for the first semester, which is 50 % more than the initial success criteria. The MOOC 'Wind Energy' was launched on Coursera.org in February 2017. When submitting this report it has attracted more than 70.000 learners of which 22.063 are active and 2.273 has completed the course. The student feedback is very positive and many ask for more courses by DTU Wind Energy.

#### *Research:*

The department's research in 2017 has met the expectations, set up in the action plan. The research outlook has improved by a significant increase in the funding from EU and national funding programs (30 mio. DKK more than in 2016). However, the profit from commercial activities is still essential for execution of the research strategy. One of the most difficult but important decision has been to abolish the Section for Material Research and Characterization. Half the employees will continue in other sections, and the other half will continue in the department of Mechanical Engineering, where a better strategic fit is envisaged. It has been a key priority to handle this process in the best way.

While core activities are undertaken at the section level, three research and innovation programs ensure an effective planning, alignment, and coordination of the research and innovation efforts – from the generation of research ideas to the effective implementation of the projects and ultimately providing added value to the

industry and society. This has been enabled by a strengthened administrative support, and by applying a more strategic approach by the program management, leading to i.e. an increase in the quality of the proposal-writing process. Several cross-cutting initiatives has been implemented and new initiatives have been developed in order to be implemented in 2018, among those *Big Data in Wind Energy & Digitalization, Systems Engineering, Virtual Atmosphere for Wind Energy Simulations and Inflow & load measurements on the V52 Research Wind Turbine*.

The department has been working proactively at national as well as European level to express and advocate for the importance of medium to long term research – to supplement the established consensus on energy research that public funding should focus on the higher TRL's, bringing technologies the final step to the market. Fortunately, this concern is more and more explicitly being shared and voiced by industry and politicians. This effort must continue but it is very positive that both the national partnership Megawind and the European partnership ETIPWIND have clearly stated the need for medium-to-long term research, not just to help universities but to stay competitive by being leading on technology. Finally, as recognition of the important role and academic profile of the department, DTU hosted the Wind Energy Science Conference 2017 (WESC-2017) together with the European Academy of Wind Energy (EAWE) with the support of EERA.

#### *Scientific advice:*

The department provides research-based fact-finding, consultancy and advisory services to Danish and international authorities on technical requirements and strategies for planning and deployment of wind energy. A key partner is the Danish Energy Agency who in 2016 decided to insource the Secretariat for the Danish Wind Turbine Certification Scheme, and an agreement has been achieved on how henceforward, enabling the department to continue its' close interaction with the sector on technical requirements and standards.

The department has also led Danish Standard's technical committee for wind turbines, leading and contributing to several international standards groups. The international research-based consultancy was strengthened with the launch of the DTU centre for research based international consulting on sustainable energy solutions in cooperation with DTU Electrical Engineering and DTU Mechanical Engineering and DTU AIS in DTU REPLI. The department continued its substantial efforts within siting and integration of wind energy, including cooperation with South Africa and Mexico partly funded by Denmark as well as contracts awarded in the World Bank ESMAPR Renewable Energy Mapping Programme. The close partnership with the World Bank was demonstrated with the launch of the Global Wind Atlas 2.0 with currently over 20,000 web user sessions in 178 countries. Finally, the involvement in the International Energy Agency (IEA) was enhanced and the department now chairs the work in the area of Wind Energy.

#### *Innovation:*

Making and sustaining innovation in society in collaboration with industry has always – and will continue to be - an essential part of the department's ambition. A key activity here is the operation and continuous development of the national test centers in Østerild and Høvsøre. Both centers are essential for the Danish national R&D hub, mentioned, and highlighted repeatedly for their importance to the sector, and why the industry is keeping and developing R&D activities in Denmark. In Østerild a visitor Centre was inaugurated and both centers are being expanded.

The collaboration and commissioned research with industry has never been more extensive than in 2017. The collaboration with Vestas on testing and validation related to the innovative 900kW multi-rotor concept wind turbine installed at the test site at DTU Risø Campus has continued. This has led to both increasing revenues and very exiting research.

The collaboration with the wind energy industry sub-suppliers and SMEs has continued and the department takes part in a national program targeted at SMEs and sub-suppliers to the wind sector, but so far the results has only been limited.

## **1.2 Discussion points for Action Plan meeting**

- Multiyear planning and finance (long-term research effort in the light of short-term challenge of obtaining funding for R&D)
- Investments, including collaboration on exploitation of Research Infrastructures with DTU and external partners
- Østerild and Høvsøre

## 2. Education and teaching

### 2.1 Education and teaching

#### 2.1.1 Teaching

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Overall pedagogical skills	Ensuring high quality and the pedagogic development on existing courses, and to smooth the administration of educational issues.	<ul style="list-style-type: none"> <li>Continued development of pedagogic skills of course teachers and student project supervisors.</li> </ul>	NECL, BOMA	Ongoing. About 25 persons from DTU Wind Energy are certified supervisors for large student projects.
Master courses	Develop the teaching portfolio	<ul style="list-style-type: none"> <li>Review of teaching portfolio</li> <li>Explore the possibilities for joint courses with DTU Byg and DTU MEK</li> <li>A set of guidelines for both teachers and students are continuously formulated to avoid administrative problems and bottle necks related to the Erasmus Mundus European Wind Energy Master.</li> <li>A course on Entrepreneurship based on the Conceive-Design-Implement-Operate (CDIO) will be given.</li> </ul>	JNSO JNSO  MHHA, JNSO  MHHA, JNSO	Done. Done.  Done.  On hold because MHHA left.
E-learning	A new E-learning-based 1-year regulated part time master's education will be established.	<ul style="list-style-type: none"> <li>The first six e-learning courses will be developed</li> <li>The programme is expected to start in September 2017.</li> </ul>	JNSO, MEBA  JNSO, MEBA	Done.  Done.
Education of bachelors	BSc in General Engineering	<ul style="list-style-type: none"> <li>Follow up on curriculum and make sure that the 'Future Energy' track on wind energy can be realised.</li> </ul>	JNSO, TKIM	Done.
Grøn Dyst	Prepare for next event	<ul style="list-style-type: none"> <li>Encourage students to take part</li> </ul>	Board of Studies	Done.

Wind Car Race	Set up a new team for the race in 2017	<ul style="list-style-type: none"> <li>To win the race (again).</li> </ul>	RFMI, MACG	Nearly achieved (finished 2 <sup>nd</sup> this time).
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### 2.1.2 Evaluation

Project / area	Description	Objective for 2017	Responsible	Status IÅR
PhD supervisors	Clarification and development of the role of the supervisor.	<ul style="list-style-type: none"> <li>A survey among the PhD supervisor about their roles and the objectives of a PhD project will be conducted to identify the diversity of opinions. It will be used for a discussion and clarification of the supervisor role in the department.</li> </ul>	MHHA	Done and to be continued with head of PhD.

### 2.1.3 Education

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Development of existing study programme	E-learning will be a key driver in the development of the educational activities. The continuation of the activities in the European wind energy masters is also important.	<ul style="list-style-type: none"> <li>A plan for the continuation of the activities will be developed</li> <li>See also 2.1.1</li> </ul>	JNSO	Ongoing. Will be finalized in 2018.

### 2.1.4 Students

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Erasmus Mundus	Strengthening of the European Erasmus Mundus Wind Master (EWEM) education.	<ul style="list-style-type: none"> <li>More collaboration with industry will be established in order to get external grants.</li> </ul>	MHHA/JNSO	Done.
Recruitment	More emphasis on marketing efforts concerning wind energy educations both at other universities and at gymnasiums.	<ul style="list-style-type: none"> <li>E-learning will be used to promote wind energy educations.</li> </ul>	MEBA/JNSO	Done.
Exchange of students	To increase the recruitment of foreign students and to strengthen the international exchange of own students, contacts and exchange programmes are being established with world-leading universities.	<ul style="list-style-type: none"> <li>A concerted action on recruiting students from specially selected universities will take place.</li> </ul>	JNSO	Done. Will continue.

Wind Energy Master	Maintain that 90 % should graduate within the expected timeframe and that the percentage graduating at the expected time plus one year is 100%.	<ul style="list-style-type: none"> <li>We will try to keep this by continuous checking.</li> </ul>	JNSO	Done.
Master thesis with companies	Increased focus on cooperation with companies concerning master theses.	<ul style="list-style-type: none"> <li>We will try to keep this by enhancing the collaboration with industry.</li> </ul>	JNSO	Ongoing.

## 2.2 PhD programme

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Industry contact	Industry has requested a closer contact to the PhD students for recruitment.	<ul style="list-style-type: none"> <li>PhD students will be asked to write an exclusive summary of their project objectives and current results within their first two years of studies, which will be distributed to the relevant industry partners. PhD students are encouraged to give presentations to the industry.</li> </ul>	MHHA	Implemented and on website. Summary after 18 and 30 months.
Consolidation of the PhD supervising and information sharing	The department consists of supervisors with different backgrounds from many different universities and the PhD school is still young. It is important to have a forum where the supervisors can share experiences and hear about the DTU rules and visions.	<ul style="list-style-type: none"> <li>Quarterly PhD supervisor meetings will be held with different agendas that supports the development of the PhD school.</li> </ul>	MHHA	Implemented.

## 2.3 Continuing education

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Courses in how to use the software developed within the department	Courses in the use of WAsP, WAsP Engineering, HAWC2, HAWCStab2 and ElipSys.	<ul style="list-style-type: none"> <li>Further development of courses for the industry in application of CFD/EllipSys and EllipSys-HAWC2 coupling (High fidelity aerodynamic/structure coupling).</li> </ul>	FLRA/JABA	E-learning course for WEng launched and WAsP e-learning course continues.



### 3. Research

#### 3.1 New initiatives and development of existing research areas

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Strategic Research and Innovation Programme "Offshore"	A cross-cutting activity (CCA) on design for manufacturing, maintenance and lifetime extension	<ul style="list-style-type: none"> <li>The objective is to reduce O&amp;M costs by development of a risk and failure based methodology for design for O&amp;M and lifetime extension, partly based on analysis of actual damage in various components.</li> </ul>	KTTHO	Results will pave the way for future activities in this area. On-line model validation set up.
	A CCA on developing an operational LCOE model.	<ul style="list-style-type: none"> <li>The purpose is to develop an operational LCOE model based on the Megavind modelling complex (Excel) using a high-level cost and scaling approach</li> </ul>	KTTHO	LCOE model developed. It will be implemented in the Topfarm framework.
	DeRisk: Extreme wave loads on offshore wind turbine substructures, including CFD analysis of 3D storm sea states with breaking waves and analysis of lab data for extreme waves.	<ul style="list-style-type: none"> <li>Identification of critical load cases.</li> <li>Analysis of full scale data for wave loads on monopiles.</li> </ul>	HBRE	Done. Postponed to 2018.
	ABYSS: Develops novel mathematical models, reliable numerical optimization techniques and software for optimal design of cost effective bottom-fixed offshore wind turbine support structures	<ul style="list-style-type: none"> <li>Launch software of optimal design for offshore jacket structures</li> </ul>	MATST	First version of the software JADOP (Jacket Design Optimization) completed.
Strategic Research and Innovation Programme "Wind Turbine technology"	A cross-cutting activity (CCA) on model validation, methods and uncertainties on the V52 research wind turbine.	<ul style="list-style-type: none"> <li>Full-scale validation of turbine performance to reduce the risks and uncertainties related to design.</li> </ul>	FLRA	1-1 online validation accomplished.

	<p>Combination of mechanical and chemical surface engineering of steel components for improved fracture and environmental resistance</p> <p>Vacuum infusion moulding of rotor blades: Modelling of resin cure kinetics for understanding of induced residual stresses and shape distortions in composite structures.</p> <p>FarmOpt (EUDP): Development of new reliable tools for designing wind farms located in complex terrain through full scale measurements in wind farms.</p> <p>Major milestone in the Horizon 202 project INNWIND.EU</p>	<ul style="list-style-type: none"> <li>• Preparation and long-time testing of samples by rolling contact fatigue/pin on disk.</li> <li>• Establishment of experimental and modelling competences, within resin cure kinetics and induced residual stresses in composites during manufacturing (OptiMaDeBlade).</li> <li>• New version of WAsP and WindPRO will be available integrating flow, wake and optimization models.</li> <li>• Quantify the benefits of de-rating wind turbines using measured turbulence from a spinner anemometer.</li> </ul>	<p>DOJE</p> <p>BSQR (TOAN)</p> <p>WZSH</p> <p>ANAT</p>	<p>RCF tests running, pin-on-disc on hold due to dissolution of MAC.</p> <p>Tests conducted. Part of ongoing PhD project to be finalized 2018.</p> <p>Pending.</p> <p>Achieved using measurements from the V52 turbine.</p>
<p>Strategic Research and Innovation Programme Siting and Integration</p>	<p>A CCA on Large Eddy Simulation (LES) techniques modelling for wakes in atmospheric flow.</p> <p>XWIWA: Wind-wave coupled mesoscale modelling system for coastal extreme wind and wave conditions.</p>	<ul style="list-style-type: none"> <li>• Coupling between meso-scale and LES for co-simulation of atmospheric flow and turbine induced flow fields using high performance computing to obtain a basis for future optimization of wind farms.</li> <li>• Completion of extreme wind and wave atlas for the Danish coastal waters based on wind-wave coupled modelling.</li> <li>• New research prototype model chain using WRF and CFD.</li> </ul>	<p>HAEJ</p> <p>JABA, HAEJ</p> <p>JABA</p>	<p>First step achieved. To continue.</p> <p>XWIWA completed.</p> <p>WRF ellipsys3d advanced.</p>

	<p>NEWA: An ambitious pan-european experimental measurement and modelling project to provide advanced datasets, models and tools for wind resources over Europe.</p> <p>WindProsper: The purpose is to develop the WAsP CFD microscale model for a new downscale procedure that uses time-series instead of annual statistics.</p>	<ul style="list-style-type: none"> <li>• Two experimental campaigns performed</li> <li>• Open interface to the WAsP CFD microscale model (EllipSys3D) for easy integration to different model chains</li> </ul>	<p>HAEJ</p> <p>JABA, FLRA</p>	<p>The world's largest microscale experiment ever performed finished successfully and published in Nature.</p> <p>Interface not accomplished yet.</p>
Horizon2020	Launch of new Horizon2020 projects.	<ul style="list-style-type: none"> <li>• At least 4 new projects should start in 2017. 1 should be coordinated by the department</li> </ul>	NPHA	3 (1) started in 2017.
KICs	Climate-KIC options for funding of collaboration with industry will be investigated.	<ul style="list-style-type: none"> <li>• 1 application submitted</li> </ul>	SKNU	Done.
Quality assurance of applications	The department will continue to develop its procedures to ensure adequate coordination, priority setting and quality assurance of applications	<ul style="list-style-type: none"> <li>• The overall target is to improve the current level of external funding.</li> <li>• Implement a consolidated concept for the pre-award phase.</li> </ul>	<p>NPHA</p> <p>MATAN</p>	<p>From app. 50 mio. kr. in 2016 to 80 mio. kr. in 2017.</p> <p>Done. Will continue.</p>
Pilot programme "Societal Challenges for Wind Energy"	The department wish to complement its natural science and engineering profile with relevant social science competence to effectively address and provide evidence regarding the societal challenge of developing cost effective, environmentally friendly and socially robust wind energy planning and policy.	<ul style="list-style-type: none"> <li>• Strengthening the effort with a senior man-year contribution and two PhD's.</li> <li>• Formulation of a research strategy and action plan</li> <li>• Establishment of a network with participation from other universities</li> </ul>	NPHA	<p>Ongoing. 1 Ph.D to start in 2018.</p> <p>Ongoing in collaboration with DTU Management Engineering.</p> <p>Postponed.</p>

### 3.2 Publications

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Publications in scientific peer review journals	Stimulate publication and citations rates by developing a common framework and understanding of publication possibilities.	<ul style="list-style-type: none"> <li>Seminar on editorial considerations concerning publications.</li> <li>Continue the new PhD course on paper writing and motivate all our PhD students to take the course.</li> </ul>	DOJE	<p>Done.</p> <p>Eight PhD students took the course in 2017. Course planned again for the autumn of 2018.</p>
Effort in order to get the collaboration partners from the industry to contribute to publications	Analysis and reporting of projects with high scientific content and innovation in cooperation with industry.	<ul style="list-style-type: none"> <li>Increase the number of joint papers co-authored with industry.</li> <li>R&amp;D briefs for communication with industry developed</li> </ul>	<p>DOJE</p> <p>FLRA</p>	<p>Same level as last year.</p> <p>Cancelled due to lack of time.</p>

### 3.3 Planned applications

Project type (Grant givers and funding instruments)	Subject	Approx. scope of funds that DTU will receive (net sum in kDKK)	Collaboration partners	Responsible	Status IÅR
Danish National Research Foundation - Centers of Excellence	Microscale testing of materials (MicroLab)	50.000		BSQR	Postponed.
Innovation Fund Denmark	Project application on the design and demonstration of an aeroelastic tailored blade tip.	5.000	Vestas or Siemens	FLRA	Funded. 9.000 to DTU.
Innovation Fund Denmark	Noise from wind turbines and wind farms	10.000	Relevant industry (e.g. Siemens, LM WP)	WZSH	Not successful. Resubmission in February 2018.
Innovation Fund Denmark - Sapere Aude DFF Starting Grant	Local residual stress measurements	4.000	None	YUBZ/DOJE	Cancelled.

Villum Foundation - Villum Young Investigator	Stability of metal surfaces	9.000	None	TIYU/DOJE	Cancelled.
EUDP / Innovation Fund Denmark	Repair technology for load-carrying laminates in wind turbine rotor blades	10.000		BSQR/MATST	Postponed. H2020 application "DACOMAT" on damage tolerant composite materials (led by SINTEF) was granted.
EUDP	Experimental determination of residual life of turbine blades from Vindeby	10.000	DONG	BSQR/MATST (KIBR)	Application submitted but not granted. Resubmission in 2018.
Horizon2020 - Marie Curie	Marie Curie ITN PhD research school is anticipated in the area of aerodynamics, aero-acoustics and aero-elasticity	5.000	TU Delft, University of Stuttgart, CENER, NTUA	MHHA	Not submitted. See below.
Horizon2020 - Marie Curie	Marie Curie ITN PhD research school in the area of structural optimization of offshore support structures (ARROWS) and in the area of design of rotors (ROFROTOR)	6.000	Industry and universities	MATST/KIBR	Both unsuccessful. 9 proposal submitted in 2017 (1 granted). 13 proposals submitted in January 2018.
Horizon 2020	LCE-21-2017 Increasing the market share of wind energy systems	5.000	Selection of EERA partners	JABA, HAEJ, JCHA	Unsuccessful.
Horizon 2020 – ERC	Depending on the outcome of proposals submitted in 2016 a	20.000		DOJE, JNSO	Cancelled. Content used

	couple of applications are expected to be submitted.				in other proposals.
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#### 4. Scientific advice

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Certification and standards	The Danish Energy Agency has decided to insource the management of the Danish Wind Turbine Certification Scheme. The department supports the scheme with technical advice, investigations and standardization.	<ul style="list-style-type: none"> <li>The department will continue to work with standardization for design, testing and manufacturing of wind turbine components, as an essential and efficient way of ensuring transfer of knowledge to the industry.</li> <li>Agreement reached on scientific advice to the Danish Energy Agency.</li> </ul>	NPHA/ANAT/ PEGF	<p>New proposal (IEC 61400-8) for a standard on design/ testing of metallic structures in the nacelle submitted.</p> <p>Achieved. However, the current framework needs to be developed.</p>
International Renewable Energy Agency	The department seeks to continue involvement in the Clean Energy Ministerial Initiative in cooperation with the International Renewable Energy Agency (IRENA) with follow up projects after the completion of the Global Wind Atlas project.	<ul style="list-style-type: none"> <li>Completion and launch with IRENA of the IRENA Costing tool, commissioned by IRENA and developed by DTU Wind Energy.</li> </ul>	JCHA/JABA	IRENA costing tool completed by DTU but IRENA has not launched it yet.
Danish Energy Agency	Contribute to Energy Agency policy formulation in areas requiring scientific advises.	<ul style="list-style-type: none"> <li>The department will continue to offer scientific advice on wind energy, including wind resource assessment, site assessment and for planning and development of wind farms etc.</li> </ul>	PEJE	Advice provided in Ukraine and South Africa. Discussions re DK Offshore

				screening in progress.
DTU Wind Energy - Research-based consultancy	Strengthen the internal DTU collaboration as a means to improve efficiency and competitive strength in relation to other Danish and foreign universities and research institutes. The establishment of a DTU Centre for research based international consulting on Renewable Energy will be pursued together with other relevant departments at DTU and DTU AIS.	<ul style="list-style-type: none"> <li>• Enter into strategic partnership with World Bank on wind resource assessment.</li> <li>• Renewable Energy, Policy, Planning and Integration Advice Group (DTU REPLI) is known among the majority of the clients and partners we consider relevant related to renewable energy integration, and the first assignments with WB ESMAP or other clients are being negotiated.</li> </ul>	JCHA, JABA	<p>World Bank partnership strengthened with launch of Global Wind Atlas2.0 with over 20,000 web user sessions in 178 countries.</p> <p>REPLI launched in May 2017. REPLI partner in consortium wins the framework agreements for DK partnership activities with 4+10 priority countries incl. Mexico, South Africa, Vietnam, China.</p>
Follow-up on the Sektorudviklingsrapport "SAVE"	The department will in the coming years participate in a Development program for sub-suppliers to the wind energy sector together with the Danish Wind Energy Association and funded by Region Midtjylland and Region Nordjylland	<ul style="list-style-type: none"> <li>• Agreement with material supplies (fiber, matrix and composites for blades) on user-paid "Club" for the development of improved mechanical testing methods to show true properties of materials, e.g. tension-compression fatigue.</li> </ul>	KTTHO/SKNU/BSQR	The concept of how to organize such a project is still not mature, but highly relevant.

## 5. Innovation

### 5.1 Student innovation

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Course in Innovation	Course in innovation and entrepreneurship for wind energy students.	<ul style="list-style-type: none"> <li>A student course in innovation will be established together with representatives from industry.</li> </ul>	JNSO/MHHA	Done.
Student projects with industry	Collaboration with industry to attract more students.	<ul style="list-style-type: none"> <li>Agreement with Vestas on student projects</li> </ul>	JNSO, MHHA	Done.

### 5.2 Collaboration with enterprises

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Collaboration projects with the industrial end-users	<p>Focus will be activities like cooperate research projects, commissioned work, licensing, post-graduate education, testing, standardization, patenting and business incubation.</p> <p>Collaboration with national partners is important to develop the national cluster of smaller companies and sub-suppliers, but also to form consortia for submission of national research proposals.</p>	<ul style="list-style-type: none"> <li>Increasing activities</li> <li>Develop business model for industry co-financing of research</li> <li>Initiate 1 project under the umbrella "Udviklingsprogrammet for SMV'ere i vindmøllesektoren".</li> </ul>	<p>NPHA NPHA</p> <p>SOLI/SKNU</p>	<p>Achieved. Ongoing.</p> <p>Done.</p>
Vestas Babylon Multirotor Concept Turbine	New innovative concept wind turbine with 4 rotors on one tower developed by Vestas Wind Systems A/S. The multirotor turbine is located at DTU Risø Campus to be tested and improved together with DTU Wind Energy. The existing contract runs in 2016 and 2017.	<ul style="list-style-type: none"> <li>Deliver minimum 1 person year of research support to Vestas</li> <li>Perform measurement campaigns together with Vestas regarding relevant topics like power performance, loads, noise, power quality or other topics defined from the first results</li> </ul>	POHO/SOLI	<p>Done.</p> <p>Done. Client very satisfied and the collaboration is expanded to 2018.</p>
Licensing of software	Several of the department's key competence are utilized and made beneficiary for society by licensing software developed at the department. The licensing covers both research, educational and commercial licenses.	<ul style="list-style-type: none"> <li>The procedures for distributing the different types of software developed at the department will be aligned and professionalized. The distribution of software will, as a rule, be centralized at the department.</li> </ul>	LARN	Completed.



Intellectual Property Rights agreements	IPR can be an important instrument to establish a sustainable competitive advantages and the balance between the innovation instruments must be selected with respect to this.	<ul style="list-style-type: none"> <li>Implementation of framework agreements with key industry partners to further remove legal issues as potential barriers or delaying factors for efficient cooperation.</li> </ul>	LARN	Completed and further templates are being negotiated.
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### 5.3 Commercialization

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Wind prediction software	The innovations are mainly implemented by releasing methods and software tools in our commercial software, WAsP.	<ul style="list-style-type: none"> <li>A new version of WAsP (12) that improves resource assessments</li> </ul>	JABA	WAsP 12 released.
Blade design software	BECAS commercial license	<ul style="list-style-type: none"> <li>Increase number of sold commercial licenses compared to 2016.</li> </ul>	MATST	Sales of commercial licenses of BECAS remained constant. Several new trial licenses issued.
Aerodynamic tools	Further development of existing and future predictive tools for commercial use.	<ul style="list-style-type: none"> <li>Developments of MIRAS/Flex for aeroelastic computation</li> </ul>	JNSO	Done.
Airfoil licenses	Licenses for the existing Risø-airfoil series will be further commercialized and new airfoil series will be developed.	<ul style="list-style-type: none"> <li>Issue one new airfoil license and initiate the development of a new tip airfoil for aeroelastic tailored blades with validation in the new national wind tunnel.</li> </ul>	FLRA	Wind Tunnel delayed. Postponed to 2018.
Turbine design	Design of new flexible wind turbines and rotors in MW size, including new concepts applying aeroelastic methods and advanced control systems.	<ul style="list-style-type: none"> <li>Validation of trailing edge flap system on a MW size turbine.</li> </ul>	FLRA	Implemented on 4MW Siemens.

## 6. Partnerships

Project / area	Description	Objective for 2017	Responsible	Status IÅR
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European Energy Research Alliance (EERA)	The department is leading EERA JP Wind and has received funding to establish an Integrated Research Programme on Wind Energy (IRPWIND).	<ul style="list-style-type: none"> <li>EERA should develop the collaboration with Department of Energy and National Laboratories in the US.</li> <li>A business plan for the post-IRPWIND phase (from March 2018) will be developed</li> </ul>	NPHA	Ongoing.
			NPHA	Done.
ETIPWIND	The European Technology and Innovation Platform on Wind Energy.	<ul style="list-style-type: none"> <li>The input given to the SRA to be completed in 2016 should lead to relevant topics being included in future Horizon2020 calls.</li> </ul>	NPHA	Achieved.
MEGAVIND	Strategic partnership between research and industry in Denmark	<ul style="list-style-type: none"> <li>A more sustainable and long-term model for the collaboration should be developed.</li> </ul>	PEJE	A long term model has been developed with an annual research agenda from universities and industry.
The Danish Research Consortium for Wind Energy	The department coordinates the Danish Research Consortium on Wind Energy.	<ul style="list-style-type: none"> <li>Recommendation paper on R&amp;D needs of the sector as input to ministries and research councils.</li> </ul>	PEJE	The above-mentioned research agenda has been presented and discussed with EUDP and the Innovation Fond.
National Laboratory for Renewable Energy (NREL), USA	DTU Wind Energy has a MoU with NREL, including description of collaborative work programme.	<ul style="list-style-type: none"> <li>Common leadership of the IEA System Engineering Annex.</li> </ul>	FLRA/LARN	Achieved and now operating.
World Bank	Strategic partnership for comprehensive exploitation and continued development of the Global Wind Atlas and ESMAP wind resource mapping activities	<ul style="list-style-type: none"> <li>Agreement on partnership and implementation of integration of Global Wind Atlas in World Bank ESMAP services</li> </ul>	NPHA	Achieved. See also chapter 4 mentioning the launch of the

				Global Wind Atlas.
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## 7. Human resources

### 7.1 Organization

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Improving cross sectional cooperation	In January 2016 the department was reorganized with the establishment of two new sections and five programmes. The purpose of the reorganization was to support managerial proximity, improve cross sectional cooperation, strengthen the scientific environments and ensure the continuous renewal and flexibility of the organization.	<ul style="list-style-type: none"> <li>Continuously working with the cross-sectional mind-set in particular through the program managers and the VLF group</li> <li>An evaluation of the new organization has been made.</li> </ul>	NPHA	The cross-sectional mind-set has developed in e.g. VLF, department meetings, and will increase between some sections in 2018.
Developing the new organizational set-up	Five members of the management group have been given an additional role as programme manager for one of the five cross-disciplinary programs as described in the previous chapters.	<ul style="list-style-type: none"> <li>The evaluation of the new organization will have a particular focus on programme management.</li> </ul>	NPHA	The Programme management structure has been evaluated and developed. Closed.
Strengthening internal coordination of ideas, submission of applications for funding and execution and evaluation of projects	The department has made it as a prioritized task to boost the pre-award phase for submission of application. In particular focus is on ensuring adequate coordination, priority setting and quality assurance in the proposal preparation process.	<ul style="list-style-type: none"> <li>One-pagers with project ideas are made at the start of all research projects.</li> <li>One-pagers are coordinated at regular meetings to improve the design of projects</li> <li>The management secretariat offers assistance in application writing for all larger applications.</li> </ul>	NPHA/SKNU	Done in most cases. Will continue. Done.  Implemented.
Strengthening of project competencies	Project management is a key area at DTU Wind Energy and we strive to continuously strengthen this competency in the year to come.	<ul style="list-style-type: none"> <li>All projects have a steering committee.</li> <li>The DTU Wind Energy project guide is updated where relevant.</li> <li>Initiatives to strengthen individual project management competencies are taken (i.e. courses and knowledge sharing among</li> </ul>	NPHA	The department will strengthen this competency and especially skills in facilitating

		project managers and steering committee members).		meetings, in the year to come.
Administrative support	The department will be developing the administrative support and give room for new competencies.	<ul style="list-style-type: none"> <li>The new management secretariat and the administrative secretariat are positively evaluated.</li> </ul>	NPHA	Done.

## 7.2 Leader and leadership development

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Continuous development of "DTU Wind Energy Management Forum" (Vindenenergi's Ledelsesforum - VLF)	<p>With smaller and more narrowly defined sections new managerial roles respectively as team leader, task leader and research leader/professor have been defined to fulfil various managerial tasks in the sections.</p> <p>Approximately 20 persons have been entitled to a managerial role. Together with the management group the 20 persons make up the Wind Energy large management group (VLF).</p>	<ul style="list-style-type: none"> <li>Yearly management 2-day seminar for VLF.</li> <li>Approximately 8 meetings for VLF members are held covering relevant managerial themes.</li> </ul>	PEJE  PEJE	VLF had 5 meetings in 2017. No seminar took place and the next VLF 2-days seminar is expected to be in 2019.
Continuous development of the management group	Continuous development of the management group is needed to meet current managerial challenges and ensure continuous renewal and flexibility of the organization.	<ul style="list-style-type: none"> <li>Yearly the management group has a UMV seminar</li> <li>Quarterly seminars for the management group is held by CFL and others</li> </ul>	NPHA	Four management seminars has taken place. This will continue in 2018.
Continuous individual development of head of sections and programme managers	Likewise continuous individual development of the managers is needed.	<ul style="list-style-type: none"> <li>New leaders are enrolled in the DTU management program within two years of appointment.</li> <li>Individual activities are arranged when relevant.</li> </ul>	NPHA	Done.  Done.
Employees with management potential	Wind Energy continuously pays attention to having talented employees to fill in open positions also at managerial level.	<ul style="list-style-type: none"> <li>At the yearly appraisal relevant employees are asked about their possible managerial ambitions on a longer term.</li> <li>Some employees attend DTU "willingness for management".</li> </ul>	NPHA	The department will continue with special successor planning

				programmes in 2018.
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### 7.3 Employee development

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Career development for all groups of employees	The department is continuously working with career development for all groups of employees. In the coming period the department will see whether a more strategic and consistent usage of DTU internal courses, including I-DTU, can be made for groups of employees.	<ul style="list-style-type: none"> <li>A guide to relevant competence development (including DTU courses) for all personnel groups are developed.</li> <li>The career guides for scientific personal and the development engineers are updated where relevant.</li> </ul>	NPHA	The career guides for scientific personal (VIP) will be updated in 2018 with KPI's.
Pedagogical courses for new and experienced teachers	The department strongly encourages all who are involved in teaching to qualify by taking educational courses.	<ul style="list-style-type: none"> <li>All teachers that are responsible for a scheduled course must have passed UDTU or a similar pedagogical course. This also includes experienced teachers that did not already have had the possibility to follow a pedagogical course.</li> </ul>	NSQR/NECL	4 teachers from DTU Wind Energy were enrolled in UDTU. At present, about 20 persons are certified teachers (UDTU/UP or equivalent).
Develop good skills in proposal writing and project design	It is expected that approximately 75 % of the total budget in the planning period will come from external sources.	<ul style="list-style-type: none"> <li>Learnings from successful and non-successful proposals are taken.</li> <li>Initiatives are made to share experiences in proposal writing among relevant employees.</li> </ul>	SKNU	Done.  Done.
Communication	DTU Wind Energy seeks to ensure that employees are able to communicate ideas, priorities and results to a range of international professional and non-professional target groups.	<ul style="list-style-type: none"> <li>Project managers are given support to communicating results.</li> </ul>	SKNU	Done. For projects of strategic importance, a communication plan is used.

	Web-packages have been developed to assist project managers disseminating information on various platforms.	<ul style="list-style-type: none"> <li>The DTU Wind Energy web-packages are being used by project managers.</li> </ul>		The web-packages have been revised so less effort is being used for project-specific websites. Rather focusing on explaining the good stories in various media.
Industry knowledge	It is important the employees have a good understanding of the wind energy sector and how their work contribute to creating value to the sector.	<ul style="list-style-type: none"> <li>Representatives from the industry are invited to department meetings.</li> <li>Employees are encouraged to engage in network activities with industrial partners.</li> </ul>	NPHA	Done.  Done. Ongoing.
Code of conduct	DTU has made a Code of conduct for research integrity.	<ul style="list-style-type: none"> <li>VIP employees participate in the planned educational activities as a way of encouraging a culture of scientific excellence</li> </ul>	PEJE	Accomplished.

#### 7.4 Attracting and recruiting

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Intensified focus on recruiting qualified employees from Denmark and top 100 universities	Over the last years it has become more challenging to recruit Danish employees to scientific positions, especially PhD positions. For that reason the department pays attention to be visible also among Danish students. Also the Department will consider ways of receiving applicants from top 100 universities. As regards TAP positions special focus will be given on attracting craftsmen.	<ul style="list-style-type: none"> <li>A working group has analysed possibilities for taking initiatives to strengthen awareness of job possibilities at DTU Wind Energy among Danish students and students from leading international universities.</li> </ul>	NPHA	AS a resultat DTU has markeded the Education at national and European Wind conferences. The total number and the number of Danish

				students have grown.
Improvement of the recruitment process	Evaluate the process for employing senior scientists and consider a more systematic use of personnel tests.	<ul style="list-style-type: none"> <li>• A new process for internal evaluation before external evaluation will be implemented.</li> <li>• Consideration will be given to use personnel tests when relevant.</li> </ul>	NPHA	The DTU recruitment process is followed and department process is optimised.
New international employees	DTU Wind Energy is proud of having many nationalities. In order to obtain the full benefits of the international environment the department is aware of the need to understand different cultures.	<ul style="list-style-type: none"> <li>• International employees are encouraged to engage in DTU IFS activities.</li> <li>• Danish and English lessons are offered when relevant.</li> </ul>	NPHA	The employment recruiting (international/ Danish) ratio is 3:1.
Promote better gender balance	The department will investigate possibilities to promote a better gender balance in the department among others through the recruitment process and at communication platforms. DTU Wind Energy has few female employees.	<ul style="list-style-type: none"> <li>• An internal working group will be formed to suggest possible initiatives to promote a better gender balance, attract, and sustain skilled female students and employees.</li> </ul>	NPHA	The DTU cultural analyses started in November 2017.

## 8. Material resources

### 8.1 IT

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Computer cluster	DTU Wind Energy needs to acquire a new cluster in 2017-2018. This can be done as a DTU Wind Energy initiative or a DTU initiative, which is preferred. It is expected that the needs from DTU Wind Energy alone is in the order of 10.000 cpu's equipped with infiniband interconnect.	<ul style="list-style-type: none"> <li>• Together with DTU Central and AIT we plan to initiate the formal EU regulated process of purchasing a new high capacity HPC facility.</li> </ul>	POHO	Tender is out early 2018.
Computational resources	It is important that DTU Wind Energy keep track of the computer resources. Hence, this is evaluated	<ul style="list-style-type: none"> <li>• HPC Jess has a high average load and a major task in 2017-2018 is therefore,</li> </ul>	POHO	Implemented.

	once a year to see if it is needed to expand the computer capabilities and current workload on the HPC facility jess indicate a foreseeing demand for its extension/replacement.	together with AIT, to create and implement a set of functional rules in order to ensure as smooth as possible usage of Jess resource for DTU Wind Energy users.		
Enter into new software licenses and agreements	DTU Wind Energy develops several software products distributed to the industry on commercial basis. Further professionalization of these efforts will be pursued to ensure continuity in the development and the documentation in order to make it more accessible and attractive for industry.	<ul style="list-style-type: none"> <li>Processes for distribution of the departments' software are aligned and new procedures are implemented.</li> <li>Ensure professionalization and continuity principles and guidelines from a newly developed software policy are implemented.</li> </ul>	LARN	Completed.  Ongoing.
Development of an IT policy	An important task of the IT committee at DTU Wind Energy has been the development of an IT policy that in the future will continue to develop detailed procedures for IT-security based on DS484 (based on ISO27001 today).	<ul style="list-style-type: none"> <li>Version 1 was developed in 2015. This will be updated and developed continuously every year in the future. Focus in 2017 will be on formalizing working procedures to streamline them with the rest of DTU.</li> </ul>	POHO	DTU Wind Energy use AIT support and are doing fine.
Development of a software strategy	DTU Wind Energy develops several software products distributed to the industry on commercial basis. Further professionalization of these efforts will be pursued to ensure continuity in the development and the documentation in order to make it more accessible and attractive for industry.	<ul style="list-style-type: none"> <li>To present and implement the newly finished software strategy. The software strategy will be an important tool when developing and distributing software at the department.</li> </ul>	LARN	Completed. As next step, a task force has been established to further strengthen the development and distribution to enhance the impact.

## 8.2 Laboratory equipment/scientific infrastructure

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Grid test facility for Test Center Østerild and The Test Station for Large Wind Turbines at Høvsøre	The Test Centre's geographical location and facilities allow for the wind turbine industry in collaboration with DTU and other research institutions to carry out research, development and tests of prototype wind turbines and new wind turbine technology.	<ul style="list-style-type: none"> <li>Specification, tendering, ordering and commissioning of a medium scale converter-based test facility to be connected to the Research wind turbine at the DTU Risø site as a pilot R&amp;D platform.</li> </ul>	POSQ	Technical specifications draft reviewed and ready. Tendering



				postponed to 2018.
Offshore wind power and grids integration lab	The laboratory allows for research and development for offshore wind power and grids integration, especially in the area of wind power plants connected via HVDC and converter control and interactions.	<ul style="list-style-type: none"> <li>• Specification of lab equipment including lab scale converter hardware.</li> </ul>	NIAC	Ongoing; basic functional specifications defined. Building 300 prepared. Will continue in 2018.
Development, instrumentation and calibration of the new National Wind Tunnel	The wind tunnel model which can be e.g. a wing section is mounted in the test section, and while it is exposed to the artificial wind from the fan the pressure is measured both on the wing section and on the walls of the test section to determine the forces that the model is exposed to by the air.	<ul style="list-style-type: none"> <li>• The construction of the Danish National Wind Tunnel, now called the Poul la Cour tunnel, will be finalised mid-2017. In connection to this the aerodynamic test section will also be finalised together with the instrumentation. Furthermore, instrumentation to carry out acoustic measurements like microphones.</li> </ul>	CHBA	Inauguration to take place in Spring 2018 and the tunnel will be instrumented and calibrated so that it is ready for external users in the autumn 2018.
Existing blade test facility	The facility has one test stand capable of testing 30 m blades or other large structures under static loading.	<ul style="list-style-type: none"> <li>• A test campaign of subcomponent blade sections to failure in compression will be finalized. Equipment in the facility will be moved to the new DTU Large Scale Facility. Existing facility will be closed.</li> </ul>	PEJE, Kim Branner	Subcomponent test campaign in IRPWind finalized. Equipment moved to DTU Large Scale Facility and facility closed.
DTU Large Scale Facility for testing of large structures and component	DTU Large Scale Facility is part of Villum Center for Advanced Structural and Material Testing (CASMAT). The facility has strong floor and three test stands capable of testing 45 m, 25 m and 15 m blades or other large structures. The facility is	<ul style="list-style-type: none"> <li>• DTU Large Scale Facility build and fully operational, Instrumentation and calibration of loading and measuring equipment.</li> </ul>	Kim Branner	DTU Large Scale Facility is operational. Official

	equipped with advanced measuring equipment and servo-hydraulic actuators for complex static and dynamic loading.	<ul style="list-style-type: none"> <li>• First static and fatigue blade tests initiated.</li> </ul>		opening on Nov. 7, 2017. First static and fatigue blade tests to be performed January-February 2018.
Continuous upgrade of "Fiberlab" to ensure that the laboratory is maintained at high international level	The FiberLab facility supports cross disciplinary research projects and commissioned work.	<ul style="list-style-type: none"> <li>• The FiberLab facility expands with increased basic research into fiber composite constituents as well as realization of fiber composite test specimens, sub-structures and medium sized components.</li> </ul>	BSQR	Gradual expansion. Prototype and subcomponent manufacture activities continue in cooperation with AER and SAC.
Mechanical testing laborator	It is important that our testing facilities for mechanical testing of new materials are constantly kept at a high international level.	<ul style="list-style-type: none"> <li>• Upgrade with a 500 kN test machine suitable for fatigue testing.</li> </ul>	BSQR	The new 500 kN machine arrived in December 2017.
Instrumentation of the Research wind turbine	The DTU research wind turbine is the main platform for full scale test and demonstration of new ideas and new concepts.	<ul style="list-style-type: none"> <li>• Modernization of the turbine control system and installation of more advanced inflow measurement equipment, noise measurements and WindScanner measurements.</li> </ul>	POHO	Partly achieved. Issue with Vestas on control system.
The European WindScanner Facility	WindScanner.eu is included in the Danish and European roadmap on Research Infrastructures.	<ul style="list-style-type: none"> <li>• To succeed in getting national funding for the next phase of WindScanner.eu.</li> </ul>	HAEJ	Not achieved but the proposal is still on the national roadmap.
Equipment for measurement of noise	DTU Wind Energy is building up competences and equipment to measure aerodynamic noise in the whole chain from the source on the blades to emission to the ground and propagation in terrain.	<ul style="list-style-type: none"> <li>• The equipment will be professionalized and standardized to be able to make an experiment on a MW size turbine in the</li> </ul>	FLRA	Noise validation measurements

		landscape involving all aspects in order to characterize the noise condition.		ongoing on V52.
Build-up of materials processing and characterization infrastructure to become a leading materials competence centre within wind energy	The MAC section is in the process of upgrading its experimental facilities for processing, characterizing and testing of metallic materials and components of direct relevance to the wind sector. This means enhanced focus on design of metals with improved performance and reliability in particular by surface engineering and by incorporating effects of local inhomogenities and defects and by analyzing materials performance under different mechanical, chemical and physical loading.	<ul style="list-style-type: none"> <li>The rolling contact fatigue machine in operation.</li> <li>The pin-on-disk test facility in operation.</li> <li>Investigate funding possibilities for: i) equipment for through thickness chemical analysis, e.g. by a glove discharge optical emission spectrometer and an atom probe, ii) surface processing by friction sliding and ii) very local hardness measurements by a nano-indenter.</li> </ul>	DOJE	RCF test rig operational and running Pin-on-disc put on hold due to dissolution of MAC.
Develop a project portfolio around drivetrain testing together with industry and LORC and upgrade the drive test facility	Develop a project portfolio where the drivetrain test facility is a central element, including definition of test procedures for drivetrains connected to the grid in a test facility in accordance with the Megavind strategy 2016 on Test and Demonstration Facilities. The drivetrain test facility if feasible will be upgraded so as to be able to test wind turbine nacelles of 2-3MW capacities connected to a DC grid and exposed to mechanical loading.	<ul style="list-style-type: none"> <li>Develop a Danish Innovation Fund Proposal to establish the process for HALT/CLT testing of wind turbine nacelles.</li> <li>If feasible obtain approval from <i>Bygningsstyrelsen</i>, initiate building construction and concrete floors for the said purpose and select commercial vendors for actuators and prime mover.</li> </ul>	PEJE	Discussed but not finalized.

### 8.3 Premises

Project / area	Description	Objective for 2017	Responsible	Status IÅR
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Buildings	<p>DTU Wind Energy, Risø Campus – building 227, 228, 229 and 235 is presently shared with DTU Energy, and to a lesser extend with DTU Mechanical Engineering. In the UNILAB scenarios the materials sections from the Island will be co-located near the other Department buildings at DTU Risø Campus. A Campus plan for DTU Wind Energy is not ready yet hindering an efficient development of the department. Re-location of the activities in these buildings will require investment in equipments which are presently shared between DTU Wind Energy and DTU Energy</p> <p>Laboratory and workshop facilities for the preparation of wind turbine and component experiments, including instrumentation and test of up to 55 meter blade for the new research turbine and existing test turbine at Risø Campus.</p> <p>At Lyngby Campus the department has 27 staff members in building 403. Flexible offices in Lyngby are needed for staff normally based at DTU Risø Campus.</p> <p>Re-establish a guest house near DTU Risø Campus to attract more foreign scientist.</p>	<ul style="list-style-type: none"> <li>• Start renovating building 101 and 100. And start building new laboratories and workshops. Both as path of UNILAB funds</li> <li>• Finalize the new large scale facility</li> <li>• At the Lyngby campus start renovating building 403</li> <li>• Find solutions with Boligfonden DTU for accommodation of guest researchers and Ph.D.'s near the Risø campus.</li> </ul>	PEJE	<p>In 2017 program work for renovation of building 101 and 100 has been nearly finalized together with CAS. Also a program has been made for a new laboratory building for COM and a TEM Workshop. Large scale facility finalized. Building 403 in Lyngby renovated. No solution for guest researchers has been found.</p>
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## 9. Communication

### 9.1 Networks

Project / area	Description	Objective for 2017	Responsible	Status IÅR
DTU Alumni	Several persons in the network have indicated an interest in the activities of the department.	<ul style="list-style-type: none"> <li>• A plan for utilising the group will be developed</li> </ul>	SKNU	Postponed.

Strengthen research network within DTU	Strengthen the research cooperation on wind energy at DTU.	<ul style="list-style-type: none"> <li>Yearly meeting with relevant department heads will take place to coordinate the efforts.</li> </ul>	NPHA	Done.
Danish Wind Industry Association	DTU Wind Energy is a member of the Danish Wind Industry Association (VMI) which comprises most organizations active in wind energy in Denmark.	<ul style="list-style-type: none"> <li>The department take part in various workshops developed in collaboration with VMI and host 1 workshop targeted at SME's.</li> </ul>	SOLI/SKNU	Partly achieved. The department did not host a workshop.
Offshoreenergy.dk	DTU Wind is member of Offshoreenergy.dk. Here is a great opportunity to get in contact with the sub suppliers to offshore wind energy.	<ul style="list-style-type: none"> <li>Continuous strengthening of the industrial network within offshore O&amp;M through participation in the O&amp;M network under offshoreenergy.dk.</li> </ul>	KTHO	Done. Ongoing.

## 9.2 Activities in relation to potential students

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Participation in Åbent Hus/Forskningens Døgn	Yearly public awareness event at DTU/Risø Campus.	<ul style="list-style-type: none"> <li>The department will participate in the event and also other events at Lyngby Campus and Risø Campus.</li> </ul>	SKNU	Participated in Lyngby as well as Roskilde. Will participate in both in 2018 as well.
Summer Schools	AU organises a yearly Summer School in Wind Energy where the department is contributing.	<ul style="list-style-type: none"> <li>The department partly organizes and contributes to the event and seeks contacts to potential future students and employees.</li> </ul>	JNSO	Done. Will also offer summer schools in 2018.
High Schools/Gymnasium	E-learning course (MOOC) aimed towards High Schools in Roskilde.	<ul style="list-style-type: none"> <li>Pilot project on e-learning implemented.</li> </ul>	HAEJ/MEBC	Postponed due to prioritization of other things (e-learning master).
Erhvervspraktikanter	Offer 'praktikpladser' to school pupils.	<ul style="list-style-type: none"> <li>Receive up to 6 "erhvervspraktikanter" (in week 40).</li> </ul>	KAAL	Done.
Summer courses	Maintain the two newly established summer courses.	<ul style="list-style-type: none"> <li>46800 Research Immersion – DTU Wind Energy and MatLab together with DTUCompute.</li> </ul>	NECL	Cancelled due to few students.

### 9.3 Contributions to boosting DTU's profile

Project / area	Description	Objective for 2017	Responsible	Status IÅR
Participation in the public debate	The department will play an active role in the public debate on Wind Energy.	<ul style="list-style-type: none"> <li>Chronicles, articles etc. will be submitted to relevant newspapers when suitable.</li> </ul>	NPHA/PEJE/SKNU	In 2017, a new record for stories in the external media – both in Denmark and worldwide - was set.
Branding DTU	Participation in conferences and meetings with the wind energy sector and the energy sector.	<ul style="list-style-type: none"> <li>Conferences like EWEA are of focal importance to network and knowledge sharing with peers and the wind energy stakeholders.</li> </ul>	SKNU/AWER	Participated in several conferences with a department booth (London, Herning and Amsterdam).
Online department communication	The department will continuously use the DTU-based online web-media as a primary source of information to the public as well as a limited number of other social media and sites.	<ul style="list-style-type: none"> <li>The department website will be relaunched.</li> <li>Boosting the department on YouTube and LinkedIn.</li> </ul>	SKNU	Relaunched in April 2017. Done.
Project website dissemination	The department will focus on dissemination of project online/web based	<ul style="list-style-type: none"> <li>A new structure for the project dissemination will be fully implemented.</li> </ul>	SKNU	The implementation has started. Ongoing.
Communication strategy	Professionalize the communication strategy and efforts.	<ul style="list-style-type: none"> <li>The strategy formulated in 2017 will be implemented.</li> </ul>	SKNU	Strategy presented and discussed at department meeting. Implementation ongoing.

Communication meetings with other departments & DTU	Meetings four times a year with other communication officers + DTU Communication	<ul style="list-style-type: none"> <li>• Work closely together, get better acquainted, learn from each other</li> </ul>	CBHE	Done – the group is also coming to DTU Risø in 2018. Inauguration of DTU Large Scale Facility together with DTU Byg and DTU AFR.
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## 10. Process and employee involvement

The department strives to ensure optimal involvement of the employees in the UMV and annual planning process to ensure that the strategy is implemented from the top management to employees. The planning is done within the framework of the strategic research programmes. Strategic goals has been identified and described as part of the internal planning procedure. The results of this process are coordinated and adjusted by the department management and the heads of sections. Importantly, each section has its own planning process, which feeds in to the UMV and this annual Action Plan. Each section has its own “UMV-skema” that is being updated in a yearly cycle following the general UMV process. An Annual Follow-up Meeting with each section has taken place. Here the results and challenges from the past year are presented and discussed. This feeds in to this report.

Parts of the report are discussed and drafted by subgroups. The HR section is also discussed with the local staff cooperation committee (LSU). Educational initiatives are discussed in the Board of Studies (studienævn) as well as in the Educational Committee. A first description of how we handle course evaluations and communicate the outcome to the course responsible, section heads and management have been discussed and formulated. The second level is the education level where course prerequisites and progression links is established. This is handled by a regular contact with the Head of studies of Wind energy (MSc) in our educational committee and by contact to Head of studies of Sustainable Energy (MSc) and Production and Construction (BSc). The panel of users of our candidates (aftagerpanel) is also a part of the “circle of quality” and we had prior to the UMV discussed the overall profile of our educational programmes and ideas for new courses.