

**Status Report for DDMF – January 23, 2017**  
**Period: July 1 – December 31, 2016**

**Project: Global Wind Energy Shipping and Logistics PhD research project**  
**– Project no. 2012-97**  
**Partners: Aalborg University**

This status report will elaborate on the following:

- Project summary
- Project organization
- Project status compared to milestone plan
- Actual costs compared to project budget and deviations explained
- Project risk analysis
- Signatures and dates

**Project summary**

Referring to the application (dated August 17, 2012 + January 24, 2013), the project has the following goal, scope, and deliverables:

- *Type of research project: A 4-year PhD research project jointly funded by Den Danske Maritime Fond (DDMF) and Aalborg University commencing on February 1, 2013 and to be completed January 31, 2017 (revised date of completion will now be May 9, 2017 due to paternity leave and ensuing employment extension of PhD Fellow Thomas Poulsen in 2016)*
- *Research objective: To understand the global wind energy shipping and logistics market up to 2050 with an aim towards mapping out the revenue potential for different shipping and logistics entrants as well as determine capabilities required to gain leadership in this market*
- *Research angle: How the Danish maritime sector and supporting industries used to have the undisputed leading edge and how they can prevent losing this vantage position completely to other emerging global players*
- *Geography: Global project scope including Denmark, Europe, China, Asia, USA, the Americas, and the rest of the world. With Denmark being “the cradle” of the global wind industry and China being the largest market in the world at this time from all perspectives, a special focus will be put on these two countries.*
- *Output: 3 conference/journal articles/book chapters, 1 PhD thesis, and 4 industry reports*

The project is planned with the following content / main tasks to be completed:

- A. *Wind energy market sizing and outlook: Market development in phases up to 2020, 2030, and 2050 including technological development*
- B. *Wind energy supply chains: Configurations, set-up, and structure*

- C. *End-to-end wind energy supply chain costs: Break-down and quantification of costs and revenue potential for shipping / logistics services*
- D. *Analysis of constituencies who participate in wind energy shipping and logistics tasks including review of what it takes to compete in this market*
- E. *Winning strategies and business models with a focus on market consolidation/M&A for shipping and logistics companies who wish to serve the global wind energy market*

### **Project organization**

The research project is organized as per the table below as of the end of December, 2016:

<b>Project sponsors</b>	Den Danske Maritime Fond (the Danish Maritime Foundation) Aalborg University, Department of Mechanical and Manufacturing Engineering
<b>Industry Reference Group</b>	Reference Group members: DONG Energy, Siemens Wind Power, Danish Shipowners' Association, Port of Esbjerg, DTU Risø Wind, Offshoreenergy.dk, BBC Chartering, FTI Consulting, NSG Wind, Give Goodwind, Per Aarsleff, AH Industries, Head Energy, DHL Global Forwarding, and A.P. Møller-Mærsk
<b>Project leader and PhD advisors</b>	Lars Bo Henriksen (LBH), Professor, PhD, AAU (lead-advisor) Poul H Kyvsgaard Hansen (PHKH), Associate Professor, PhD, AAU (co-advisor)
<b>Project administrator</b>	AAU, Department of Mechanical and Manufacturing Engineering administration, Poul H. Kyvsgaard Hansen, Associate Professor, PhD, AAU
<b>Project team</b>	Thomas Poulsen (TP), PhD Fellow, MBA, AAU

During the half year period of this reporting, the following organizational issues have arisen:

- The salary situation remained unchanged.
- New organizational plan of combined AAU Mechanical and Manufacturing Engineering and AAU CIP departments in Copenhagen has been further planned and the faculty of the departments split in two. The future plans in regards to the research area of global wind energy shipping and logistics have not yet been decided upon and discussions did not include TP.
- Several people changes within the Reference Group companies have taken place and new Reference Group companies have been included.

### **Project status compared to project milestone plan**

The project plan consists of five areas or phases to be dealt with over the 4 year period (see activity and time plans included in this document). The table below presents an overview of recent progress and predicted next steps. The table contains not only the five areas but also updates on project and stakeholder management activities as well as a status on progress towards completion of the promised DDMF final deliverables.

Project phase / area	Completed tasks	Next steps
<p><b>Project and Stakeholder Management</b></p>	<p>The 7<sup>th</sup> Advisory Board / Reference Group meeting took place at the Danish Shipowners' Association offices in Copenhagen on August 24, 2016 including a subsequent "go-home" meeting. Key conclusion of the meeting was that offshore wind Operational Expenditure (OpEx) varies by a factor of 9.5x in different cost studies perused making its share of overall levelized cost of energy vary from 13% to 57%. Logistics conservatively makes up 24% of OpEx costs and is therefore an area to be focused on by offshore wind farm operators.</p> <p>Collaboration was progressed with researchers (PhD students) from other institutions in DK working on similar projects. Collaboration was also furthered with researchers from DTU Risø Wind, Boston University, and AAU (Rasmus Lema).</p> <p>Participation in the Offshoreenergy.dk Cost Reduction &amp; Innovation Forum (CRIF) was continued both in general and specifically in terms of journal manuscript completion for work efforts rendered within focus area number 4, O&amp;M logistics.</p> <p>Continuation of collaboration DTU Risø Wind where a PhD exchange program was initiated for Thomas Poulsen as of August 10, 2015. Key contact at DTU remains Charlotte Bay Hasager who is the PhD exchange in-charge and sub-advisor of Thomas Poulsen.</p> <p>Meetings and continued dialogue with PhD network partners and Reference Group members such as Danish Shipowners' Association, DHL Global Forwarding, Vestas, Rønne Havn, Offshore Center Bornholm, DTU Risø Wind, Give Goodwind, Esbjerg Havn, DONG Energy, BBC Chartering, Head Energy, FTI Consulting, and Offshoreenergy.dk</p>	<p>8<sup>th</sup> Advisory Board / Reference Group meeting to take place at Comwell Conference Center Bella Center in Copenhagen on March 29, 2017 including a subsequent "go-home" meeting. Reference Group member structure may be altered to cater for disruption in the trucking and heavy lift segment and to expand the supply chain extent covered.</p> <p>Project steering to be continued.</p> <p>Academic progress to be driven by furthering the publication process of the last two academic journal manuscripts submitted to academic journals but not yet published.</p> <p>Progress collaboration with DTU Risø Wind, Boston University, AAU researchers, and others. Continue further thesis writing efforts and progress academic coverage of our topic and joint research efforts where relevant, such as case study work.</p> <p>Continued follow-up on stranded EU H2020 funding grants now including logistics in terms of LCE13 and LCE14. The objective remains to try to obtain participation of PhD Reference Group as a consortium and create a meaningful role for TP after the completion of this PhD research project.</p> <p>PhD Thesis writing finalization on-going for submission (expected May 9, 2017).</p>
<p><b>Travels</b></p>	<p>Dissemination of PhD project findings took place at the INNolog conference in Esbjerg, on December 8, 2016.</p> <p>Denmark travels for meetings with</p>	<p>Possibly complete data collection in China with COSCO case study to complete the China offshore wind work.</p> <p>Continue participation in DONG Energy Wind Power RM5 Logistics Reference Group as and if</p>

	particularly Reference Group stake-holders and key “speed boats” in the form of key academic case studies for journal paper writing (DONG Energy, Offshoreenergy.dk, DTU Wind Energy)	needed. Possibly support new DONG Energy Wind Power Product Line set-up for Logistics resulting from our research at the company.  Continue participation in Offshoreenergy.dk CRIF group 3 INNOlog and continue participation in overall CRIF.  Continue participation in Baltic Sea offshore wind logistics test center strategy efforts.
<b>Wind Energy Market Sizing and Outlook</b>	Continued dialogue with particularly DONG Energy, Rønne Havn, Esbjerg Havn, Vestas, Head Energy, Offshoreenergy.dk, DTU Wind Energy, Atkins, and Offshore Center Bornholm.	Continued involvement with DONG Energy Wind Power technology development.  Continued involvement with Siemens Wind Power technology development.
<b>Wind Energy Supply Chain Configurations</b>	Case study coverage of North American wind logistics using rail transportation continued.	Case study project contemplated with Vestas about USA onshore rail market. Additional case studies considered with A.H. Industries, Siemens Wind Power, and Blue Water Shipping.
<b>Wind Energy Supply Chain Costs</b>	Manuscript on O&M logistics case study with Offshoreenergy.dk completed and submitted to the selected academic journal for possible publication.	Continued support of Offshoreenergy.dk industry driven CRIF project.
<b>Required Wind Energy Logistics and Shipping Capabilities</b>	Continued use of semi-structured interviews used to get familiar with areas of incomplete knowledge within the supply chain.	Further dealings with industry through Reference Group, PhD Thesis defense, DDMF final conference, case studies, and other interaction to continue to update this part of the knowledge in the research project.
<b>Future role and capabilities of the Blue DK</b>	Successful EU lobbying activities which secured new logistics verbiage (inserted in H2020 LCE13 and LCE14 calls) did not result in collaboration between AAU and TP. AAU has progressed without TP in terms of LCE13 and is contemplating how to also do so for LCE14.	Understand and possibly participate in different consortia assembling to apply for the EU funding. Possibly support the application process. Disseminate results and knowledge amassed at last remaining Reference Group gå-hjem meetings, at the PhD Thesis defense session, and at the DDMF final conference.
<b>Case studies</b>	Work on further case studies (Baltic Sea offshore wind logistics test center, US onshore wind rail supply chain set-up, and Offshoreenergy.dk INNOlog I&C OWF life-cycle project) continued whereas major case study work for PhD output was completed. Journal manuscript writing process was completed and PhD Thesis writing efforts initiated in earnest.	Exploit finalizing of China case study with COSCO by attending case study trip during summer/autumn of 2016  Continue the Offshoreenergy.dk INNOlog and Baltic Sea logistics test center data collection and strategy setting efforts by continuing these case studies.

The table below presents an overview of recent progress and predicted next steps for particularly the academic/dissemination related activities and a status on progress towards completion of these.

<b>Project phase / area</b>	<b>Completed tasks</b>	<b>Next steps</b>
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<b>Academic Conferences</b>	No academic conference progress due to internal budget challenges for the project at AAU (not resolved).	Only local Copenhagen academic conference attendance possible due to continued AAU PhD project budget misalignments internally.  Possible overseas academic conference participation to be financed by TP.
<b>Academic and project Publications</b>	O&M journal paper manuscript completed and submitted to the academic journal selected. Charlotte Bay Hasager from DTU Wind Energy and Christian Munk Jensen from Offshoreenergy.dk were the co-authors.  PhD Thesis writing efforts initiated in earnest.	Academic paper manuscripts submitted to academic journals to be edited and revised in order to be published in accordance with academic journal editor instructions.  PhD thesis writing to be completed latest by May 8, 2017.
<b>Academic exchange program</b>	Academic exchange program with DTU Risø Wind in Roskilde extended, so far until May 9, 2017.	Continue DTU Wind Energy academic exchange program to complete PhD Thesis writing and finalize last joint publication together. Thesis writing support will also be provided by DTU Wind Energy researchers as and when needed by TP.
<b>Press in various media</b>	Appearance in various written media in connection with August 24, 2016 gå-hjem meeting at Danish Shipowners' Association and subsequent interview with the press on logistics innovation as a means to reduce levelized cost of energy for wind	Additional press pursued on a continuous basis
<b>PhD courses</b>	TP participated in a doctoral course entitled "Advanced Strategic Management". The PhD course was organized by INSEAD and EIASM/EDEN and took place at IESE Business School in Barcelona on November 21-25, 2016.  With this last PhD course completed, the requirement to obtain a minimum of 30 doctoral level ECTS points has been obtained. In Denmark, 30 doctoral ECTS points must be obtained in order for the PhD student to be allowed to submit the PhD Thesis.	No further doctoral courses planned to obtain ECTS points.
<b>Lecturing / Supervision</b>	Teaching and supervision obligation towards AAU has been fulfilled.	Teaching and supervision obligation towards AAU has been fulfilled.

Referring to the original project plan included milestones displayed below, it is our estimate that the project scope remains intact by now and is well on track compared to planned progress. The only exception is the 2+12 week leave of absence in connection with the birth of TP's son which has deferred the completion date from January 31, 2017 until May 9, 2017. At the same time, this does leave room for the remaining two submitted manuscripts to possibly become peer reviewed and thereby published before PhD Thesis submission on May 9, 2017.

The 14-week paternity leave will therefore only defer the original plan but not cause a delay to the planned milestones.

Activity	Year/Quarter																							
	2013				2014				2015				2016				2017							
	M3	M6	M9	M12	M15	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	M48	M51	M54	M57	M60				
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
Project management, administration and reporting to DMF	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Research assistant, +30 more ECTS points completed and Ph.d. scholarship preparation	x	x	x	x																				
Formal Ph.d training/education, dissemination/lecturing at university					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Preparation, get in place, launch of project, and setup of Reference Group	x	x																						
<b>Phase 1 - market sizing and outlook</b>																								
Work with available market data to quantify wind market size 2020, 2030, 2050		x	x																					
Work with OEM's, utilities, and available market data and technology/R+D			x	x																				
<b>Phase 2 - wind energy supply chains</b>																								
Current supply chain designs, strategies and business models						x	x																	
Future supply chains							x	x																
<b>Phase 3 - end-to-end wind energy supply chain costs</b>																								
Generic supply chain cost estimates based on averages						x	x																	
Detailed supply chain cost component analysis for sub-processes							x	x																
<b>Phase 4 - requirements for market participation</b>																								
Types of players involved in the shipping and logistics tasks								x	x															
Definitions of supply chain tasks, roles, and responsibilities now and future								x	x															
<b>Case studies throughout phases 1 through 4</b>																								
Case A - full supply chain analysis research questions 1, 2, 3, and 4 (DK)		x	x	x	x	x	x	x	x	x	x	x												
Case B - full supply chain analysis research questions 1, 2, 3, and 4 (PRC)					x	x	x	x	x	x	x	x												
Cross case analysis/conclusions and mit-term seminar											x	x												
<b>Phase 5 - how The Blue Denmark can maintain or regain leadership</b>																								
Blue Denmark survey									x	x	x	x	x											
Wrap-up of Blue Denmark study work and matching to cross case analysis													x	x	x									
Final seminar																				x				
Attendance of conferences, industry fora, and events	x		x		x		x		x		x		x		x		x		x					
Industry interviews and site visits as relevant	x	x	x	x	x	x	x	x	x	x	x	x												
Workshops, seminars, and speeches at conferences					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Publication of 4 articles for academic conferences / journals													x	x										
4 industry reports for Den Danske Maritime Fond					x	x							x	x										
Stay abroad at foreign academic institution																								
Ph.d thesis finalization																				x				

Internal AAU discussions pertaining to the PhD project budget were neither progressed nor resolved. As such, continued case study efforts were financed by TP independently of AAU at the recommendation of the AAU PhD advisors and with their full and open blessing/knowledge/consent.

The PhD exchange program at DTU Wind Energy worked exceptionally well and a second journal manuscript was completed and submitted jointly during this reporting period. The welcome and support from DTU Wind Energy has been very good under the leadership of Charlotte Bay Hasager.

The publication targets for the PhD are on track. Three conference papers have been submitted, peer reviewed, and presented at academic conferences in 2013 and 2014. Three manuscripts have been submitted, peer reviewed, and published during 2015 and 2016. Two additional manuscripts have been submitted for publication in 2016. One additional and not yet published manuscript is in the process of being written as an extended chapter of the PhD Thesis.

The PhD thesis writing process has commenced in earnest and is on track for completion latest by May 8, 2017.

**Actual costs compared to project budget and deviations explained**

Due to complexity in the financial setup, the financial statement will be reported separately.

### Project Risk analysis

Below is an overview of main factors posing a risk to the project not meeting its deliverables for the rest of project period as well as current strategies for their mitigation.

Potential Main Risks	Strategy of Mitigation
Loss of key resources / persons from project team due to unforeseen circumstances, particularly TP.	Mitigation of the working conditions and working situation of TP has not been successful but the overall situation has stabilized despite the inaction on the part of AAU. AAU denied to provide further external counseling support to TP. Work with the union and workers council did not produce results.
Significant budget changes on the part of AAU.	The PhD project continued to be re-scoped, altered, and restructured to match the reality. This was mainly done through case study funding on the part of TP at the request of the AAU PhD advisors and with their full blessing/consent.
Lack of project steering	An internal AAU project steering meeting was conducted on July 8, 2016. Regular meetings about the academic progress took place between LBH and TP via Skype. DDMF has a standing invitation to join any and all Reference Group meetings and/or call bilateral meetings as and when needed and as such, DDMF attended the gå-hjem part of the August 24, 2016 Reference Group meeting.
Wind energy loses strategic importance as an energy source across the world	The global outlook for wind energy continues to look favourable up to and including 2050 where up to 30% of the world's energy production could be generated from wind power.
Scope too wide or unrealistic?	The prior work experience, knowledge of wind energy/shipping/logistics/strategy/M&A, and 18 years' overseas work experience of TP has made the scope practically attainable. The PhD project is set to finalize on time and with an intact scope.
Access to companies and empirical evidence not available?	Companies continue to support the PhD research project and TP with case study access, data sharing, and research design opportunities. A careful balancing of keeping the companies interested and finalizing the PhD Thesis is managed by TP in order not to create expectations which cannot be fulfilled due to the advanced stage of the PhD research project at this time.
Individual project parts / phases are not sufficiently linked, and synergies lacking across	The PhD Thesis writing process as well as the completion of the academic journal manuscript

work efforts?	writing process has worked favourably to link the different parts of the project and create an overall synergy of the research results compiled.
Project team members have different aims and interests and these can potentially develop in to conflicts between team members, e.g. also between advisors and TP as the PhD fellow.	TP has ensured that close alignment exists between the main AAU advisor and TP as well as between the DTU Wind Energy assigned advisor. Although not achieved in unison, these parallel alignment processes have worked well.
Strategy changes or major reorganizations in partner companies	The most critical case study work and data collection efforts for the PhD Thesis have now been completed. As such, the most important partner companies are the Reference Group members. Their support up to the end of 2017 and the completion of the final DDMF conference remains vital. Stake-holder management is being worked on constantly.
Lack of backup of relevant stakeholders	The PhD project is broken down into five major steps combined in three research questions. The PhD project deliverables are both short and long term. Significant effort is done to develop good presentation materials (PPTs) and reach out to important stakeholders in the appropriate sequence as the project progresses with visible results and when found relevant. Dissemination efforts, press coverage, and project output has been extensive.

**Signatures and dates**  
**Aalborg and Copenhagen, January 23, 2017**

Lead advisor, Lars Bo Henriksen, Professor, PhD, Aalborg University

Co-advisor, Poul H Kyvsgaard Hansen, Associate Professor, PhD, Aalborg University

Thomas Poulsen, PhD Fellow, MBA, Aalborg University