



Global wind energy shipping and logistics research project Industry report – year 3 (February 1, 2015 – January 31, 2016) Dissemination of research findings and project progress

PhD research project introduction

Aalborg University (AAU) is a recognized thought leader both within wind energy as well as transport/logistics. Together with the Danish Maritime Foundation (Den Danske Maritime Fond, DDMF), AAU is co-funding a 4-year research effort (the project) pertaining to the end-to-end shipping and logistics aspects of the global wind energy market. The project runs from February 1, 2013 through the end of January, 2017 and output from the project will include industry reports, seminars, conferences, peer reviewed academic journal articles, as well as a PhD thesis document. The PhD thesis will ultimately be defended by the PhD Fellow of the project, Thomas Poulsen.

The project research will first quantify the wind energy market focusing on analyzing wind turbine generator (WTG) technology as well as on-going research & development (R+D) efforts to understand the size and weight of the WTGs going forward. Subsequently, the research will concentrate on mapping out both current and future wind energy supply chains from a supply chain design, supply chain strategy, and supply chain business model perspective. Based on the supply chain mapping efforts, end-to-end life cycle wind farm costs will then be analyzed both from a generic cost estimate point of view as well as a detailed cost component analysis with comparisons to actuals, where possible. Finally, requirements for participation in the wind energy shipping and logistics market segment will be mapped and different types of players involved in the supply chain set-up identified along with their roles and responsibilities, both currently and in the future.

The research project will make use of several case studies to develop an understanding of the end-to-end global wind energy supply chains from a shipping and logistics perspective. European, Asian, and Americas data collection will form part of the case work and the case studies will be contrasted and correlated in order support the research objectives. From the case study comparison, it will be established what it takes in terms of strategies and business models to obtain leadership within the global wind energy shipping, logistics, and supply chain management (SCM) market.

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1.0 Executive Summary

The third year of the PhD research project spanning from February 1, 2015 to January 31, 2016 may be summarized as follows:

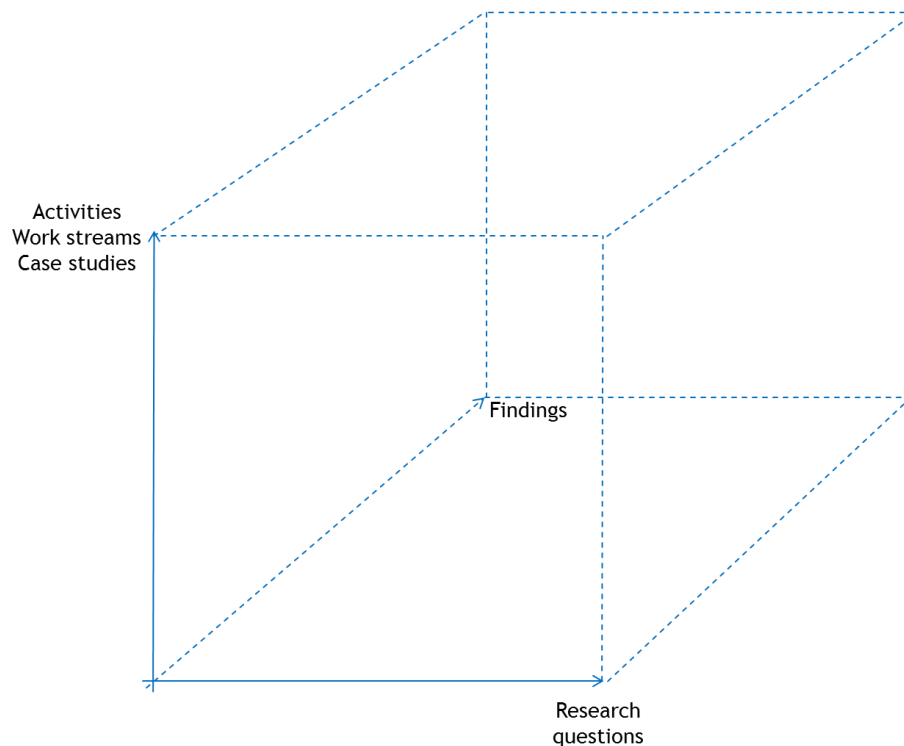
- Based on the originally defined purpose as approved by DDMF in the funding application, the research project progressed along a total of 5 work packages with three supporting research questions.
- The research process was progressed along the project structure which was defined during year 2 of the PhD project as the standard approach that shall guide the project until the end of its' life span.
- The five areas of research focus have progressed according to the plans and are all on track going into year four of the project.
- A number of project achievements have been completed during the third year of the PhD project including local and international university collaboration, academic publications, and the initiation of multiple case studies both in Denmark and abroad.
- The plan for year four of the project is to continue the on-going industry dissemination, complete two major case studies started in year two (cost reduction and China focus areas), add more academic peer reviewed publications, and to write the PhD thesis.

2.0 Research Structure

During the third year (February, 2015 ~ January, 2016), the research project progressed along a total of 5 work packages with three supporting research questions (RQ) based on the original 5 focus areas included in the funding application to DDMF as follows:

- RQ 1: The wind energy technology and wind market developments up to 2050 supplemented by supply chain definitions and configurations.
- RQ 2: The strategic role and cost of shipping and logistics in wind energy including definition of supply chain constituencies.
- RQ 3: Strategies and business models to attain leadership position within wind energy shipping and logistics. Focus on M&A.

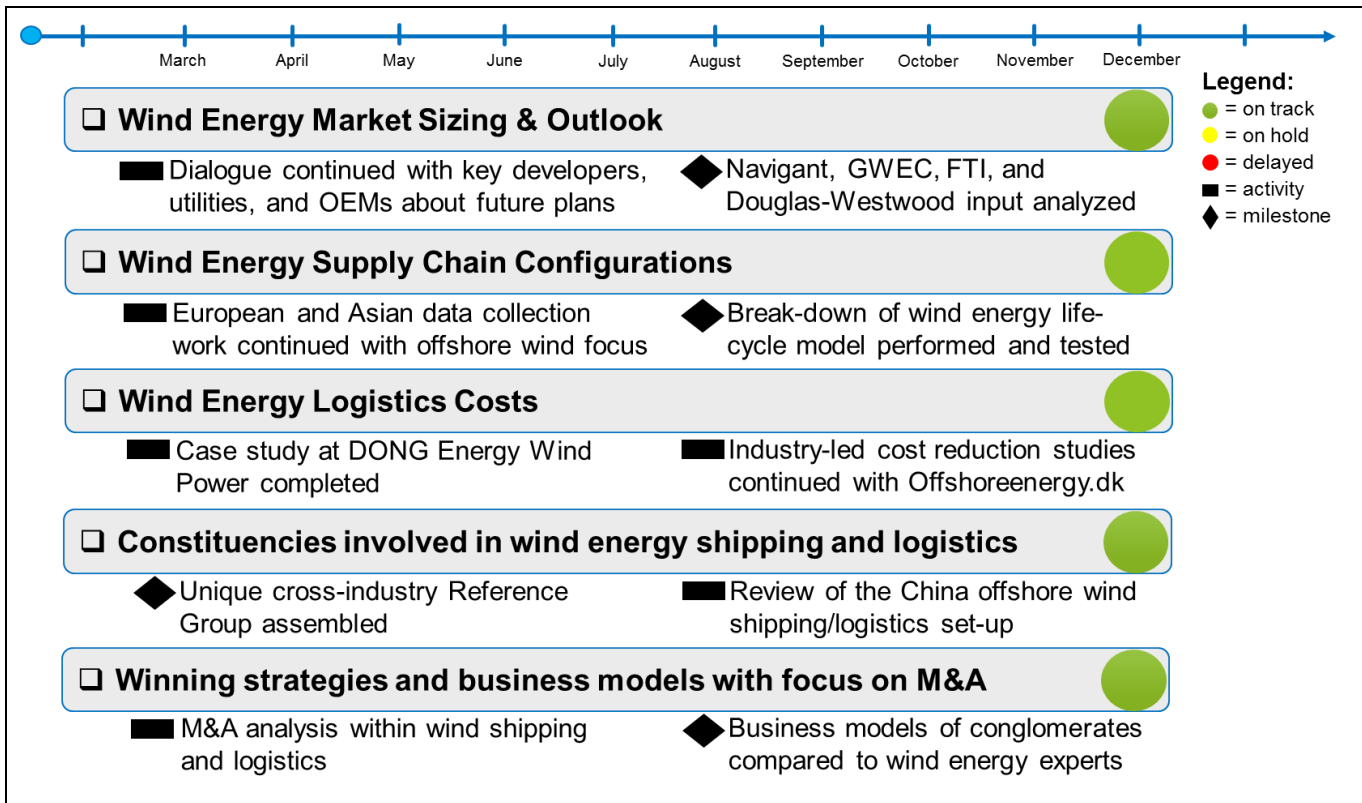
Progress of the research over time can be viewed along a three-dimensional matrix where the research questions guide the case study activities and findings are derived through the research. This process may be depicted as follows:



In the following, we will briefly provide an overview of the key work package activities, milestones, and the progress made during year three.

3.0 Year Three Status

The research has continued to consist of the five areas of focus defined during year one and which are to be dealt with over the entire four-year period. The figure below presents an overview of recent progress for the five areas as well as a status indicator covering the progress towards completion of the promised project and DDMF final deliverables.



Extensive project management activities as well as stakeholder management tasks continued to take place during the year three period:

- Mid-term conference, October 9, 2015.** As part of the Danish Maritime Days 2015, the global wind energy shipping and logistics PhD research project organized and executed the mid-term status dissemination to industry and academia alike. Conducted at AAU as part of the DMD week of 2015, this conference included 3 external industry speakers as well as the mid-term PhD project update with the key findings of the PhD. The conference was conducted as agreed with DDMF and as part of the contract between DDMF and AAU about the PhD research project.
- The Reference Group** continued to support the PhD research project:

- a. The Reference Group comprised 10 organizations by the end of year 3 including DONG Energy Wind Power, Siemens Wind Power, Danish Shipowners' Association, Port of Esbjerg, J Poulsen Shipping, DHL, A. P. Møller-Mærsk, Per Aarsleff, Navigant Research, and Offshoreenergy.dk.
- b. The 4th Reference Group meeting took place at Per Aarsleff on March 17, 2015 in Hvidovre and included a subsequent "go-home" meeting. At the go-home meeting, presentations by Per Aarsleff and AAU were made and all Reference Group members subsequently were available for questions & answers from the public.
- c. The 5th Reference Group meeting took place at Siemens Wind Power on September 2, 2015 in Brande. The subsequent go-home meeting included presentations from SWP and AAU with all Reference Group members available for questions afterwards.
- c) **Collaboration** was progressed with researchers (and fellow PhD students) from other institutions in Denmark working on similar projects:
 - a. Article writing continued with Professors Narasimhan of Michigan State University and Stentoft of SDU.
 - b. Academic research work continued with Professor Rasmus Lema from AAU.
 - c. A PhD exchange program was initiated with DTU Risø Wind starting from August 10, 2015 and here, academic collaboration was initiated with Charlotte Bay Hasager.
- d) **Case study work** along three different projects achieved status as follows:
 - a. The DONG Energy Wind Power student supported case study on logistics innovation within offshore wind was completed.
 - b. The Offshoreenergy.dk Cost Reduction Forum group 4 student supported case study on O&M logistics was continued.
 - c. The China offshore wind case study was continued.
- e) **Industry dissemination** took place through the press and at various events as follows:
 - a. EWEA Offshore Wind conference and exhibition – speakers' corner presentation, Copenhagen, March, 2015.
 - b. European Short Sea Shipping conference – presentation at CBS, Copenhagen, June, 2015.
 - c. MSSM safety, security, and environment conference – panel discussion participation, Nyborg, August, 2015.
 - d. Mid-term PhD project seminar - presentation, AAU, Copenhagen, October, 2015.
 - e. Sino-Danish annual wind seminar - presentation, Beijing, October, 2015.
 - f. HubNorth and City of Aalborg logistics and safety conference - presentation, Aalborg, November, 2015.
 - g. Baltic Sea offshore wind conference - presentation, Rønne, January, 2016.
- f) **Academic dissemination** took place throughout the year:
 - a. NEDSI academic conference, presentation based on abstract regarding sustainable supply chains in wind energy, Boston, March, 2015.

- b. Reference Group meetings in Hvidovre and Brande, March and September, 2015 respectively.
- c. Mid-term PhD project seminar, AAU, Copenhagen, October, 2015.
- g) Participation in the Offshoreenergy.dk organized **Cost Reduction Forum project** meeting in Esbjerg on October 8, 2015.
- h) Participation in the **DONG Energy Wind Power R&D Roadmap 5 Logistics forum** including the February 11 kick-off and September 7, 2015 meetings.
- i) Meetings with **PhD network partners** such as Longyuan, China Guangdong Nuclear, Envision, LM Windpower, Nissens Cooling Systems, Danish Trade Council China, ZPMC, Profundo, Amos, Head Energy, Uptime International, StormGeo, Maersk Broker, DBB Jack-Up, SBSS, Turnkey Group, Port of Aalborg, Port of Rønne, Martin Bencher, BWS, Vestas, A2Sea/CT Offshore, WWL, and FTL.
- j) Throughout the year, **training courses** were attended to obtain the required 30 ECTS points at doctoral level throughout the period of the PhD project life-cycle.
- k) **Teaching and student supervision** efforts were rendered throughout the year. Teaching was conducted in terms of the project cargo management class conducted as part of the GSD M.Sc program in Copenhagen. Student supervision was performed in terms of student projects with DONG Energy and Offshoreenergy.dk.

4.0 Year Three Achievements

Some of the key project achievements covering year three have been highlighted below. However, for full details of all completed tasks please refer to specific semi-annual status reports issued by Aalborg University as part of the project charter agreed with DDMF.

International Academic Collaboration

Year three of this project saw the progression of *academic collaboration* with Michigan State University, Boston University, SDU, Tsinghua University, and DTU Risø Wind. The joint research is set to yield specific academic papers with professors from Michigan State University, SDU, DTU Risø Wind. In addition, collaboration to produce academic papers with AAU researchers is also on-going. On-going joint research efforts also include case study work and joint data collection.

Case Studies and data collection

During the third research year, the project managed to continue a number of *deep-dive case studies*, key among which are studies across several wind farms together with DONG Energy, logistics cost-out studies in cooperation with Offshoreenergy.dk, as well as Asia based case studies primarily focused around China in collaboration with the Danish Trade Council in Beijing and Offshoreenergy.dk.

Academic Publications

A peer-reviewed book chapter was published in May, 2015 by Pearson. This was the first *academic publication* of the global wind energy shipping and logistics PhD project. The book chapter was based on the conference paper from the 2014 EDSI conference in Kolding, Denmark.

5.0 Year Three Conclusions

The overall conclusion covering the project's year three is that the research structure and plans have been duly established and followed. The overall status of the research project indicates all the defined research activities being *on track*.

The now *well established industry cooperation* including case study set-up for data collection as well as the academic collaboration platform are starting to pay off. These collaboration platforms bring extra depth to the extensive case study work and are supporting also the width and variety of the project's insight and research.

Looking ahead towards *year four*, the on-going industry dissemination will continue with the Reference Group meetings including the "go-home" meeting forum. The three major case studies started in years one and two respectively (Asia comparison, logistics innovation with DONG Energy Wind Power, and Cost Reduction Forum with Offshoreenergy.dk) will be finalized in terms of data collection and analysis. Academic paper writing will be completed.

The work with especially Professor Ram Narasimhan of Michigan State University, Professor Rasmus Lema of AAU, and Charlotte Bay Hasager should yield more duly academically peer-reviewed publications.

Continued *industry dissemination* will take place in the form of meetings, conference attendance, newspaper articles, and so forth.

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