


GLOBAL WIND ENERGY SHIPPING AND LOGISTICS

PHD RESEARCH PROJECT
5TH REFERENCE GROUP MEETING

SEPTEMBER 2, 2015, SIEMENS WIND POWER, BRANDE

Proprietary, private, and confidential

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DENMARK

Today's program

12:00-12:45	**Factory tour**
12:45-13:15	**Working lunch**
13:15-13:40	**Meeting**
13:40-15:20	**Groups w/coffee break**
15.20-15:55	**Meeting** (continued)
15:55-16:00	**Ready for "gå-hjem"**
16:00-17:45	**"Gå-hjem" meeting**

Opening and welcome

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Agenda – Reference Group

1. Meeting opening, welcome, and agenda review during working lunch
2. New/changed Reference Group member organizations / changed participants – short introduction by new participants
3. Review of scoping of PhD research project efforts from first meetings
4. Key activities since last meeting. Focus on:
   a) The "speed boats" from the PhD "mother vessel"
   b) Government relations and tailor-made grants (Horizon 2020)
   c) Concurrent dissemination of research results and findings
5. Workshop on shipping/logistics/SCM/transport innovation and R+D within global wind energy with a special focus on offshore wind – the tail that wags the dog?
6. Update on academic progress, 11-month plan, and plans going forward
7. Wrap-up, preparation for "gå-hjem" meeting, and date/venue for next meeting

Brief introductions

(organizations, participants)

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Intro to new/changed Reference Group participants

- Quick personal background
- Brief overview of the activities of your organization
- Expectations from participation in the Reference Group and research project

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Scoping from first meetings

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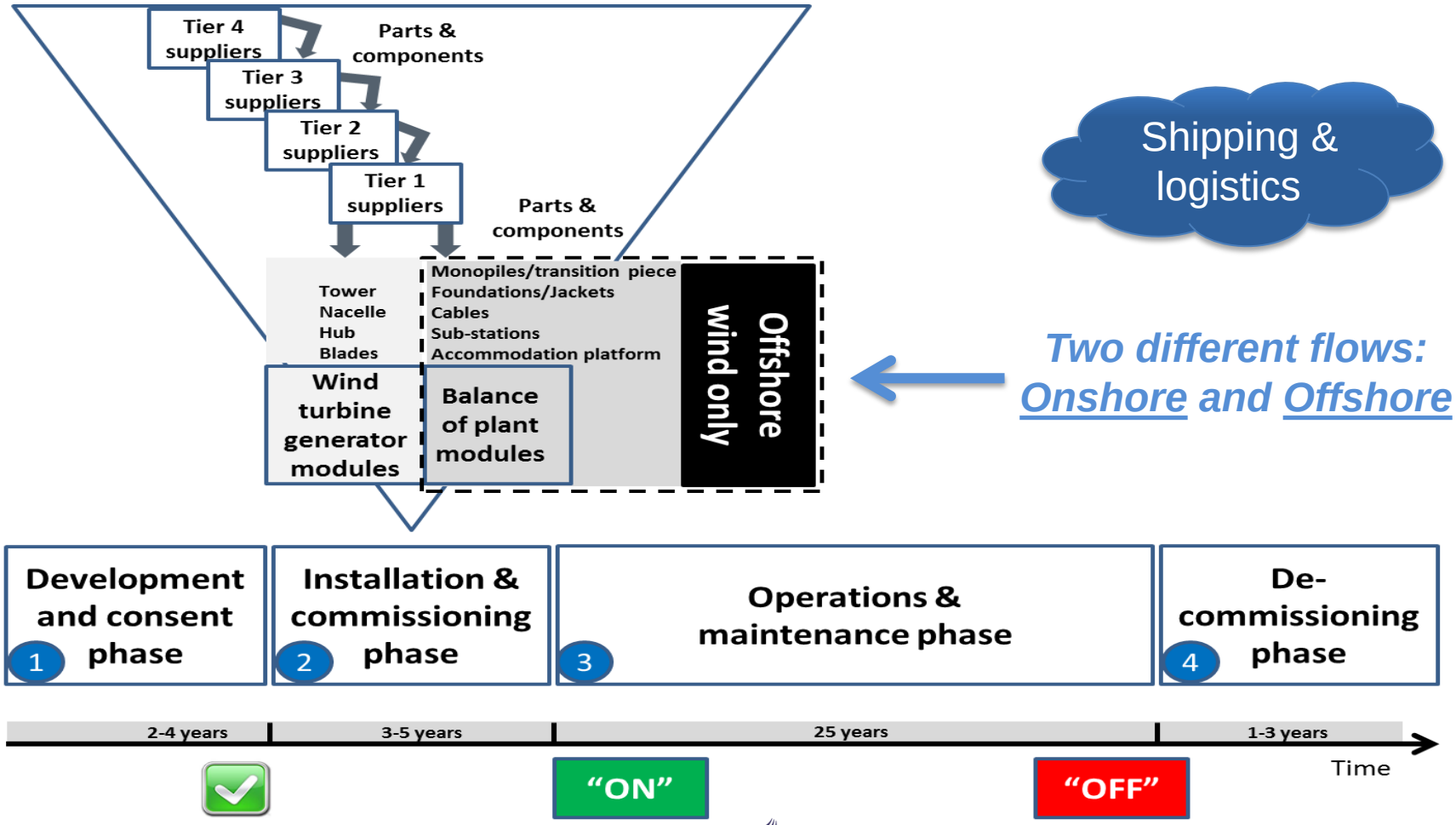
End-to-end life-cycle focus



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Source: LogMS conference paper, 2013, Singapore 2013, Poulsen et.al.

Shipping, logistics, SCM, end-to-end: *What does it really mean?*

Conclusion:

"The inbound to manufacturing assembly supply chain consists of "standard transportation" mainly by ocean and some air. This part of the end-to-end supply chain was therefore considered less interesting for the project to review than installation & commissioning, operations & maintenance, and decommissioning"

Theory / Practice linkage	Support / Lobby	Challenges /Solutions
Learn biz	Convey info	Practical and relevant / correct
Chinese market network sharing	Investments going forward (vessels, financing, etc.)	Practical background → tools
Reducing LCoE	Project timelines	Academia vs. consulting
Applied research	Offshore wind knowledge	Capture change
Good quality research	Case studies	Look at change in future
Scope: Narrow, realistic, big, complex, crystalize, etc.	Continuous "smart" goals: Concrete, specific, look ahead, value	Moving research target (in time)
On-time project	E2E wind supply chain	Bridge more industries

Source: First Reference Group meeting

Case study efforts

Number of companies

Time spent

Extent of case study scope

Depth

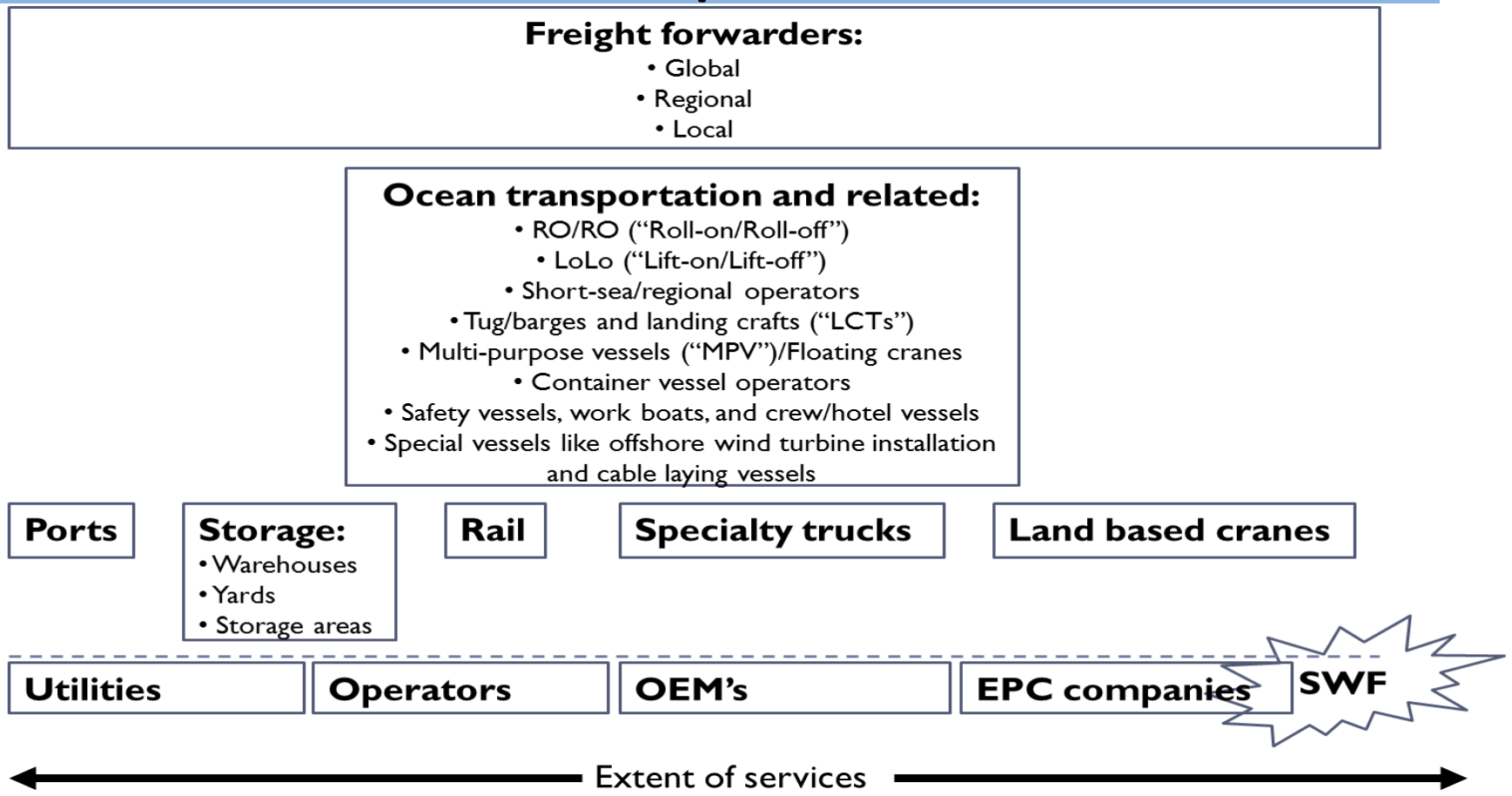
Width

Europe — *Offshore, simple and easy cases*

Asia — *Offshore, one case*

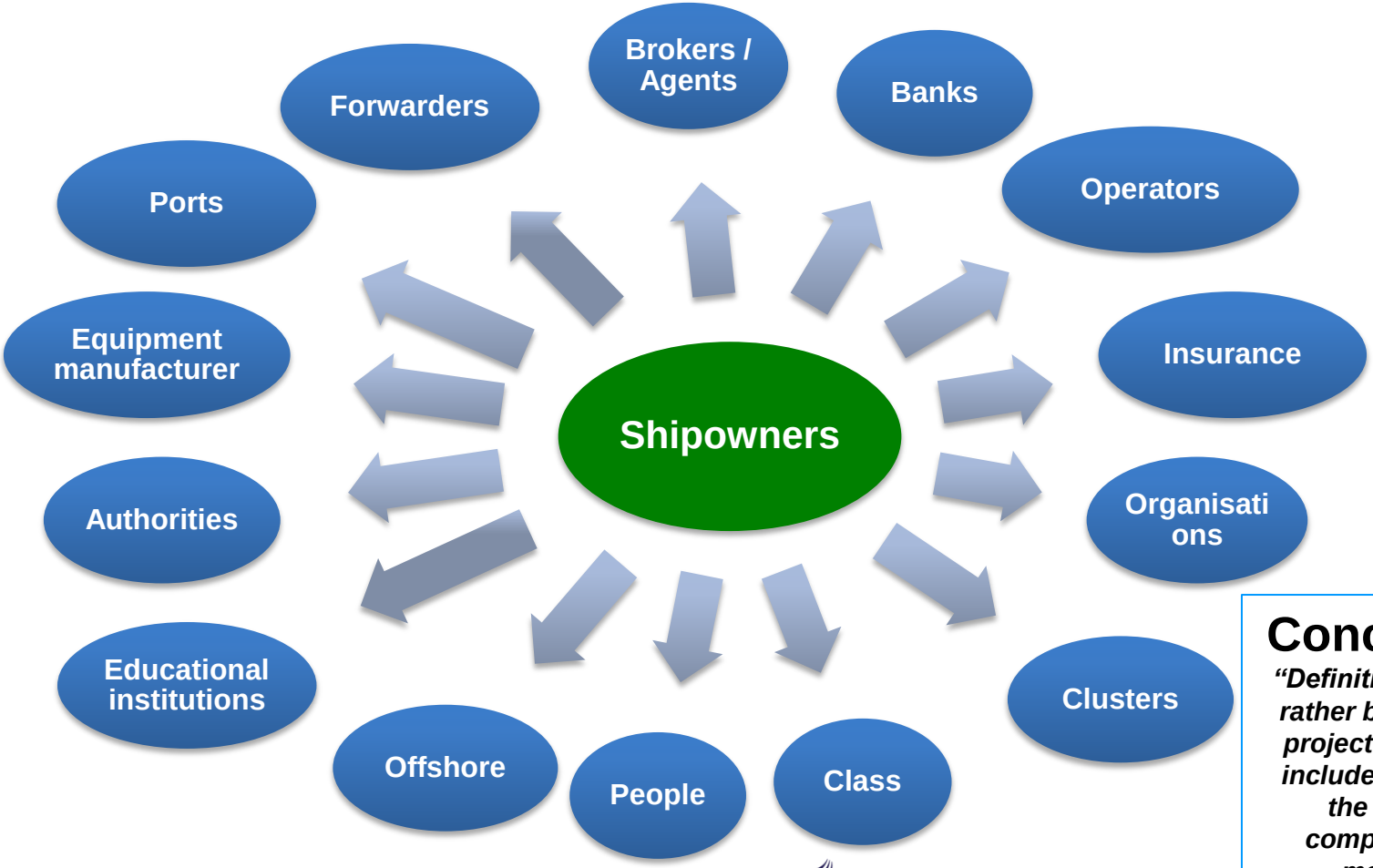
Americas — *Onhore, rail focus*

Wind energy shipping and logistics: Involved parties...



Source: LogMS conference paper, 2013, Singapore 2013, Poulsen et.al.

Definition of “The blue Denmark”

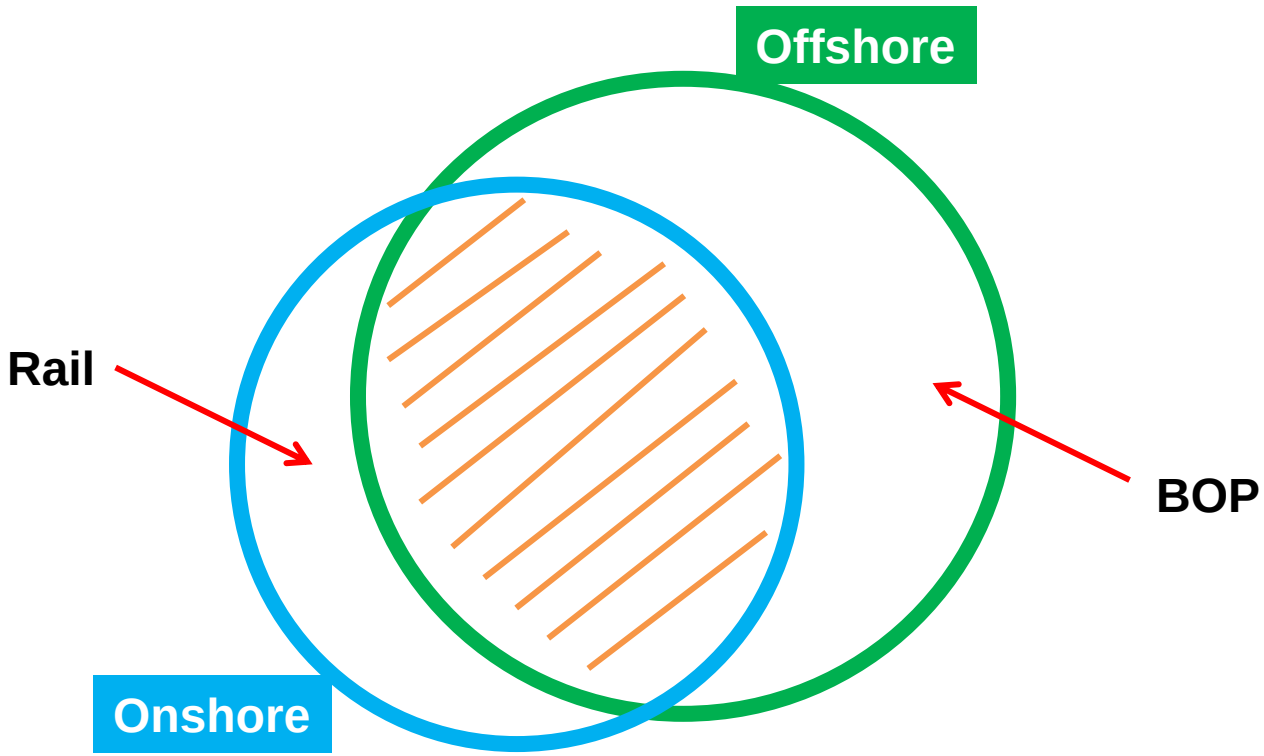


Conclusion:

“Definition should be rather broad for this project and not just include for example the shipping companies/DSA members”

Source: First Reference Group meeting

Onshore and offshore SCM



Onshore and offshore wind – Differences and similarities

Conclusion:

"Whereas both similarities and differences exist between the onshore and offshore wind farm supply chains, the offshore wind supply chain is more complex in terms of shipping and logistics"

Similarities	Differences
Inland: - Same trucks / Equipment - Daytime - Infrastructure	Sea carriage: - Assembly to site (outbound)
Port storage: - Temp. storage	Infrastructure: - Quayside loading / logistics - Diff. equipment (vertical) - Area / space (buffer) - Seamen education (outbound) - BOP - Installation / equipment / skills
Actual maintenance	Maintenance - Certificates - Transportation - Equipment

Source: First Reference Group meeting

Scoping of the Ph.d. research

First Reference Group meeting scoping conclusion:

Wind energy supply chains						
Wind farm phase	***Development & Consent (D&C)***	***Installation & Commissioning (I&C)***		***Operations & Maintenance (O&M)***		***De-commissioning (De-comm)***
Supply chains	D&C chain	I&C chain - Inbound	I&C chain - Outbound	O&M - Preventive	O&M - Breakdown	De-comm chain
Description	Site surveys, birds, wildlife, sea, seabed	Inbound assembly parts and components	Outbound wind modules for wind farm site	Personnel, parts, and components	Personnel, parts, components, and modules	Restoration of site for new wind farm or to original condition
Characteristics	Specialized vehicles (onshore) and vessels (offshore)	Mainly a homogenous flow using ocean containers and air; some project cargo	Project cargo/break-bulk	Mainly service boats, crew transfer vessels and some larger vessels	Service boats and helicopters, some larger vessels like MPV, tug&barge, WTIV	Project cargo/break-bulk

Assumed to have the largest possible impact on potential reductions of levelized cost of energy

Achievements since last meeting

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Speed boats - CRF

Offshoreenergy.dk “Cost Reduction Forum”, part II

- Start-up of logistics O&M project
- Funnel approach
  - ✓Sub-projects for top 3 ideas for lowering LCoE
- Student exam with grade 10
- September 17, 2015 summary

Speed boats – RM5 Logistics

DONG Energy Wind Power logistics R&D
RM5 Logistics strategy project, part II

- Transcription of 15 interviews
- Pilot survey to 15 respondents
- Main survey to 100 respondents
  - ➢Analysis of all findings
- 4 student exams, all with grade 10
- Final strategy submission July 22
  - ✓Reference Group review September 7

Speed boats - ongoing

Offshoreenergy.dk “Cost Reduction Forum”, part III
- Focus on Logistics O&M work stream

Offshoreenergy.dk “Cost Reduction Forum”
- End-to-end logistics process

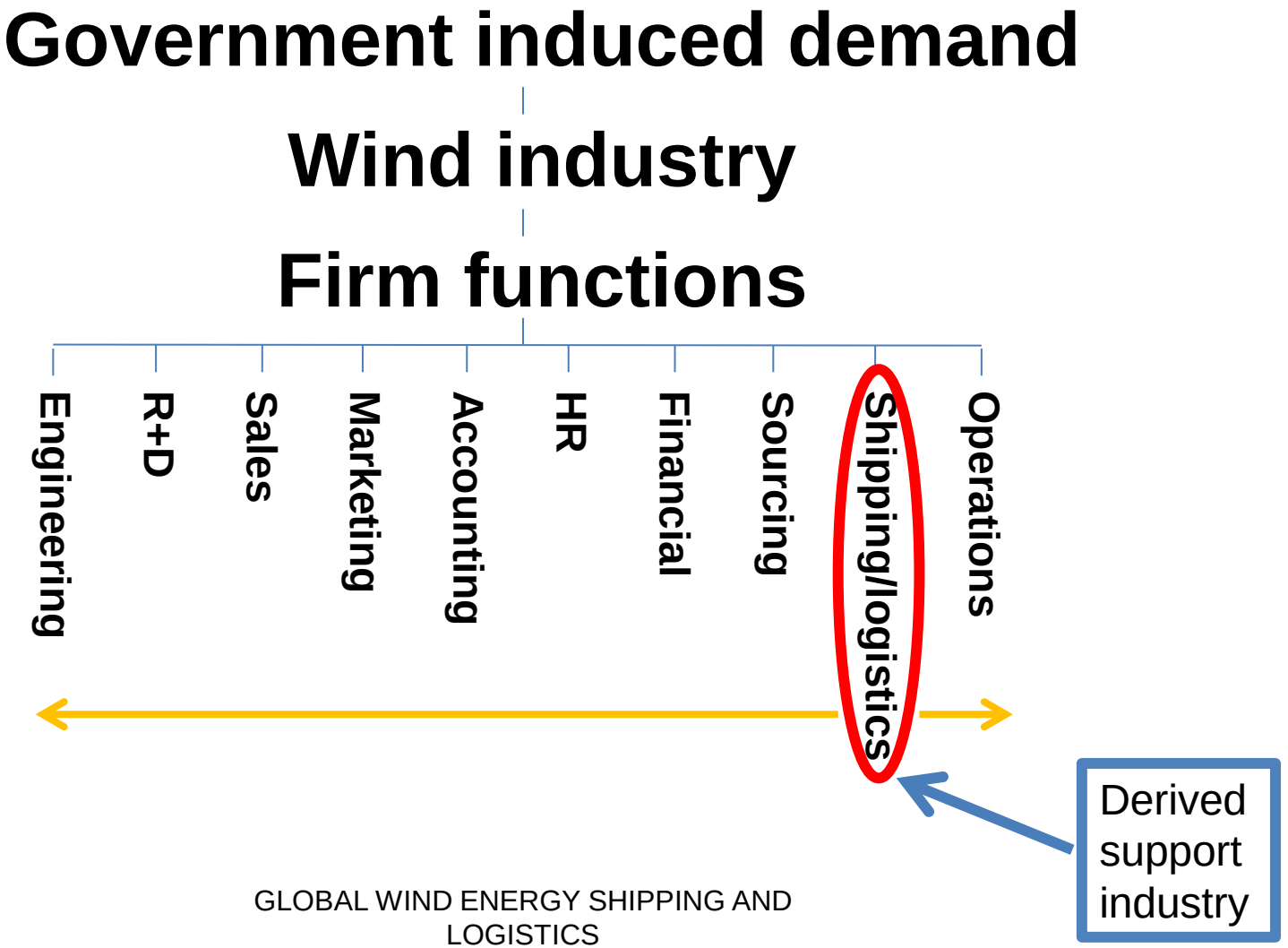
Offshoreenergy.dk China BSR project

Liftra
- China market entry project

Siemens Wind Power
- Various project proposals (buying terms, site parts, RO/RO)

Vestas
- Logistics strategy dialogue initiated

EU argument: Derived market



Government relations - EU

EU Commission H2020 WP Energy 2016-2017 lobbying status:

- Logistics and shipping text successfully inserted
- 2 separate low carbon energy calls about wind energy
  - ✓ **LCE 13 – 2016**: Solutions for reduced maintenance, increased reliability and extended life-time of wind turbines/farms (grant size ***EUR 7-10 million***)
  - ✓ **LCE 14 – 2017**: Demonstration of large >10MW wind turbine (grant size ***EUR 20-25 million***)

Huge success!

Government relations - DMD

Energy & Transport Summit, October 9, 2015, Copenhagen, Danish Maritime Days

- Mid-term PhD seminar
  - ✓Thomas Poulsen
  - ✓45 minutes

- Panel session (90 minutes)
  - ✓1 moderator
  - ✓5 speakers
    - ➢Politics
    - ➢Risk management
    - ➢HSE

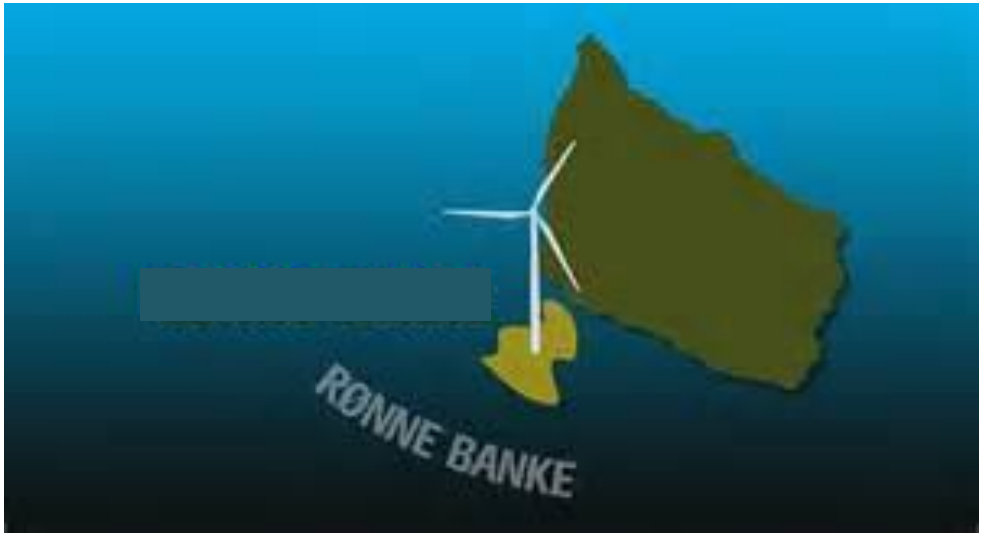
Government relations - ongoing

Test site lobbying with Rønne Havn:

1. Small scale test – DTU, Force
2. Shore turbines – Østerild
3. Other parts – LORC

Next up:

In the ocean?



MEGAVIND

Concurrent dissemination

Academic

- NEDSI conference Boston, March, 2015
- EIASM M&A PhD course, Brussels, March, 2015
- Peer reviewed book chapter published (Pearson) May, 2015
- OEDK BSR China fact-finding trip, July, 2015

Industry

- DHL conference, Copenhagen, March, 2015
- Cost reduction forum, Jutland, spring, 2015
- Short Sea Shipping 2015 conference, CBS, Copenhagen, June, 2015
- MSSM conference, Nyborg, August, 2015

Planned dissemination

Academic

- Journal paper about readiness of green supply chain, November, 2015
- Journal paper about shipping and logistics innovation DEWP case, January, 2016
- Journal paper about O&M logistics OEDK CRF case, August, 2016

Industry

- Gå-hjem meeting today
- Mid-term conference and panel on politics, risk, and HSE on October 9, 2015 at AAU CPH (in connection with Danish Maritime Days)
- OEDK BSR China delegation trip in October, 2015
- Next gå-hjem meeting in March, 2016

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Introduction of short workshop

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OWF siting is crucial

1. Distance to shore
2. Water depth
3. Number of wind farm turbine positions
4. Weight and dimensions of WTG, foundation, and other BOP
5. Seabed conditions

- ✓ Near shore
- ✓ Offshore
- ✓ Far offshore

In Europe…

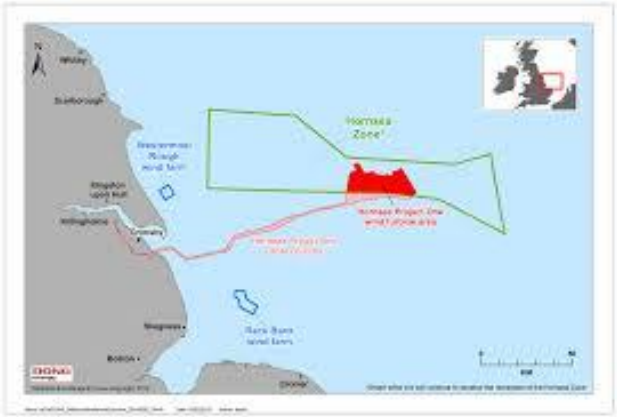
- Similar wind conditions:

➢Horns Reef III

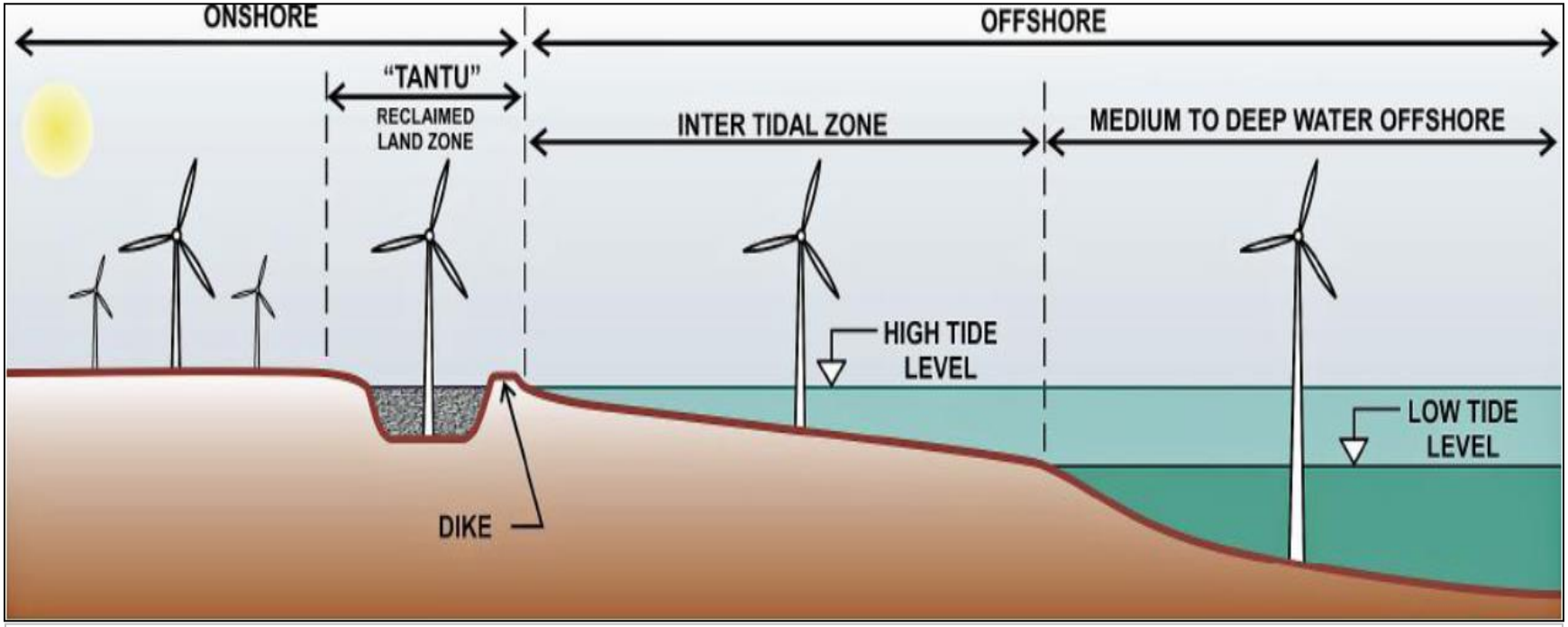
VATTENFALL

➢Hornsea

DONG energy



Example of unique China offshore-inter-tidal wind farm outbound I&C challenges

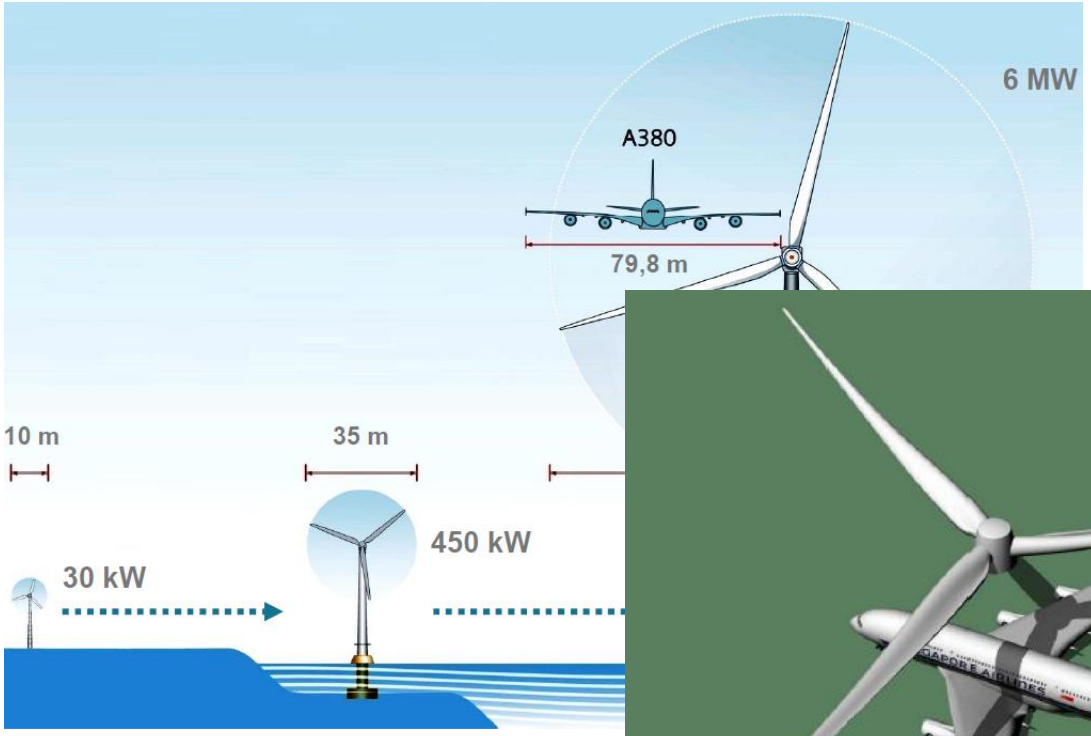


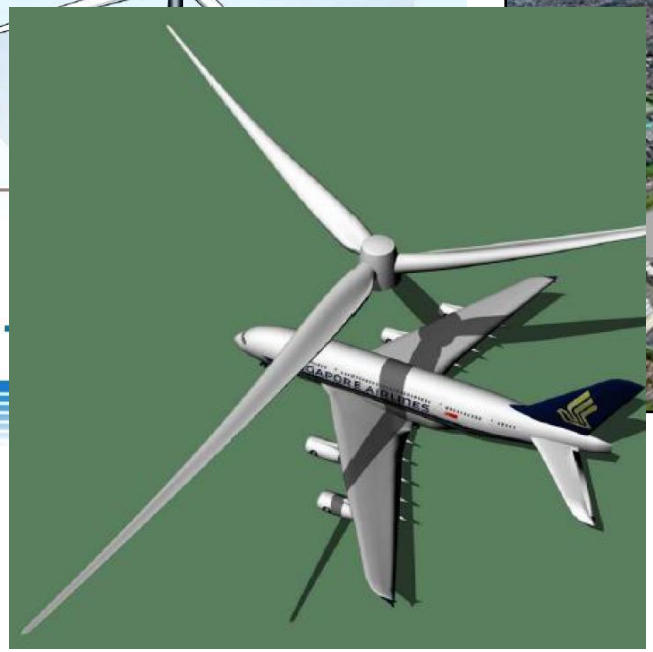
Example Jiangsu Dafeng project (installation by Longyuan Zhenhua JV):

- 30 km from shore, Western part of farm will have riverbed exposed during low tide
- Eastern part of farm will need WTIV's to be permanently jacked up out of the water
- Requires different kinds of vessels than in Europe

Source: NEA & World Bank (2010), BTM Consult part of Navigant & Poulsen (2012), and AAU research

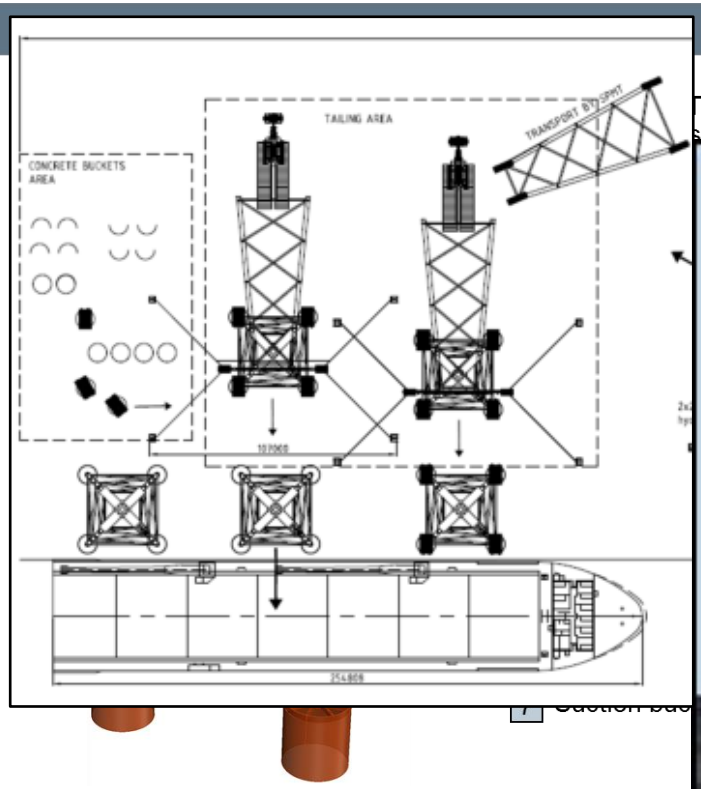
The 6 MW (7 MW) SWP WTG



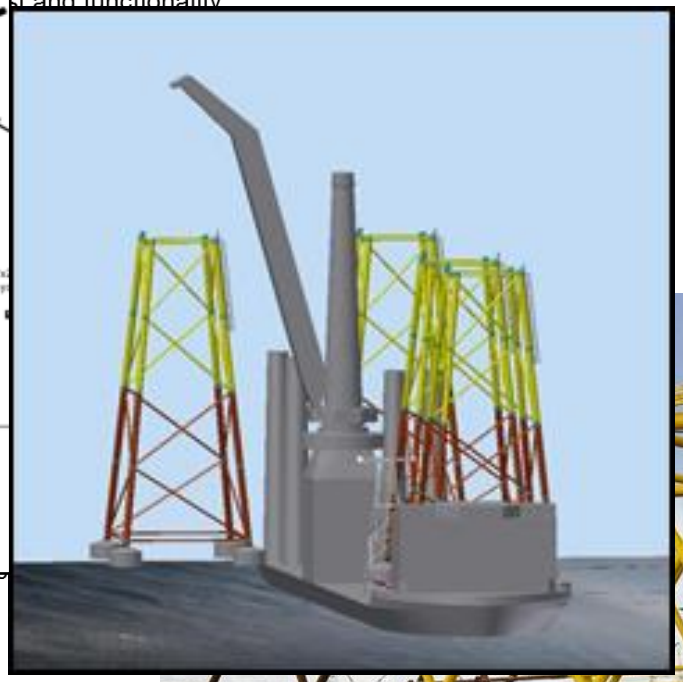


Source: Henrik Stiesdal, Siemens Wind Power, 2014

Foundations need to catch up…

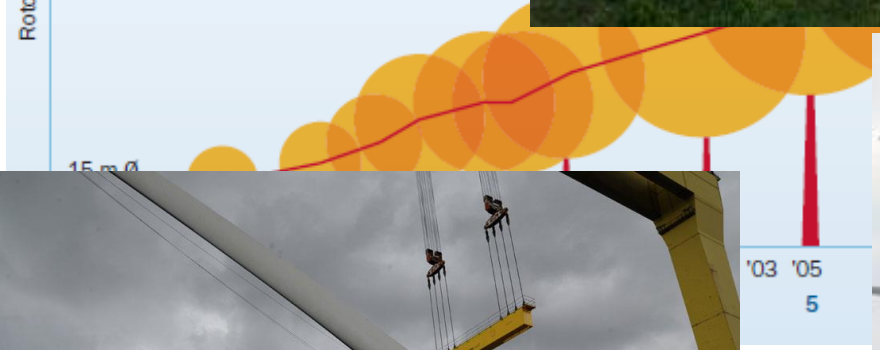


TP design with focus on simplicity,
st and functionality



Source: Henrik Stiesdal, Siemens Wind Power, 2014

The race is on for larger WTG output
- and importance of shipping/logistics/SCM



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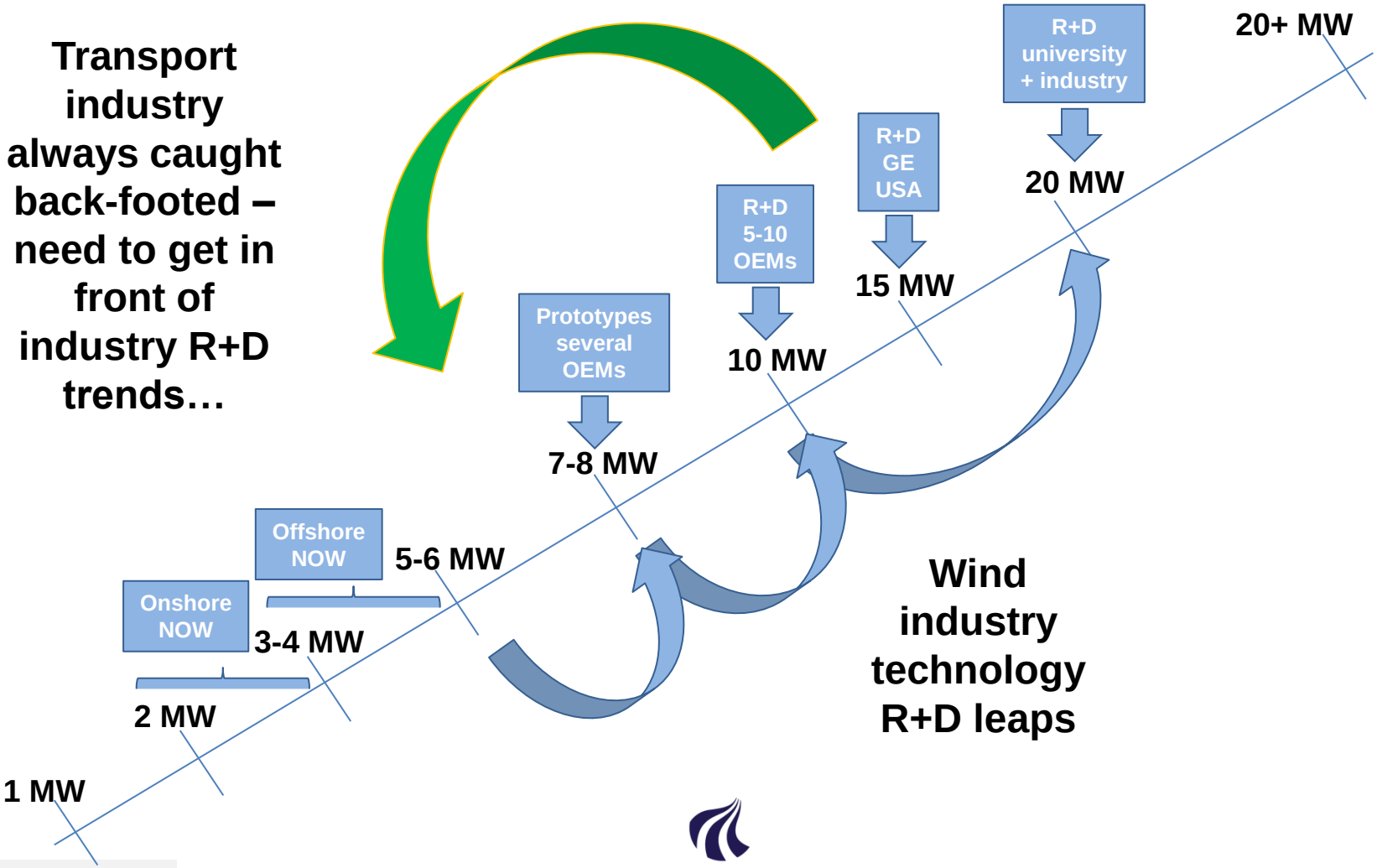
Source: Upwind Project (design limits and solutions for very large wind turbines) and Aalborg University Copenhagen photos

About knowing one's place

The tail does NOT wag the dog

We in transport know that we are basically considered coolies that just make things work...

Innovation – what comes first?



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Weight & Dimensions	Nacelle weight (t)	Blade Length (m)
Siemens 2.3 MW	82	45
Repower 6.15 MW	325	61
Siemens 6 MW	364	75
Samsung 7.5 MW		83
Vestas 8 MW	390	80

Wind R+D

Implications on:

- **Transport equipment**
- **Assets**
- **HSSEQ**

Transport Equipment

Trucks, trains, roads, bridges, storage facilities, lifting equipment, ports, vessels…

Makers of wind turbines (OEMs):

The pioneers

NEG MICON Powerful Simplicity Vestas

NASA

BONUS Energy A/S SIEMENS

GE

The "other" Europeans

ENERCON ENERGY FOR THE WORLD

NORDEX We've got the power.

ALSTOM

Gamesa

AREVA

Adwen AN AREVA GAMESA COMPANY

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Examples of the Asian "newcomers"

金风科技 GOLDWIND

SINOVEL 华锐风电

联合动力 United Power

HYUNDAI HEAVY INDUSTRIES CO.,LTD.

SAMSUNG

UNISON

SENVION wind energy solutions

SUZLON POWERING A GREENER TOMORROW

ENVISION

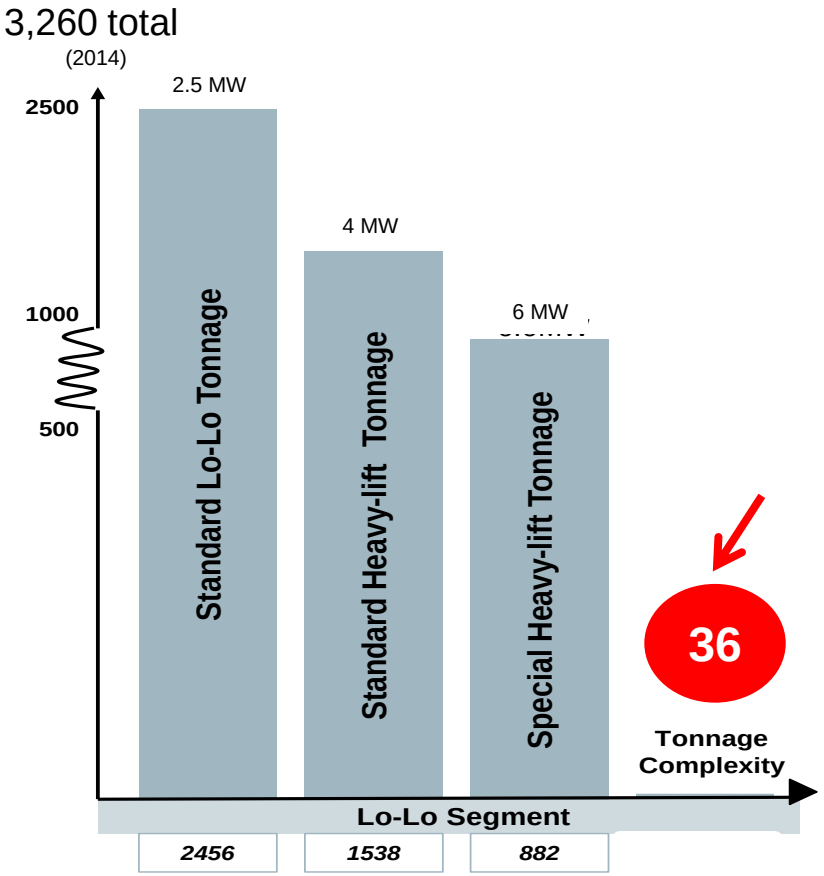
Source: AAU research, DHL Global Forwarding, Renewable Energy Solutions

Dimensions – Logistics challenges

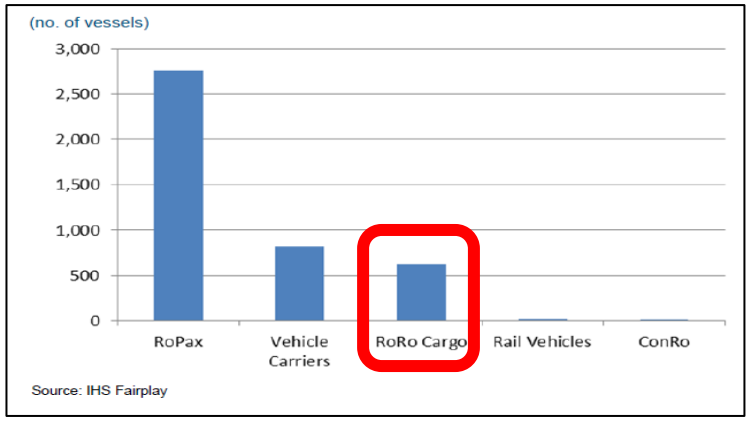
Source: Danish Shipowners' Association, courtesy Siemens Wind Power

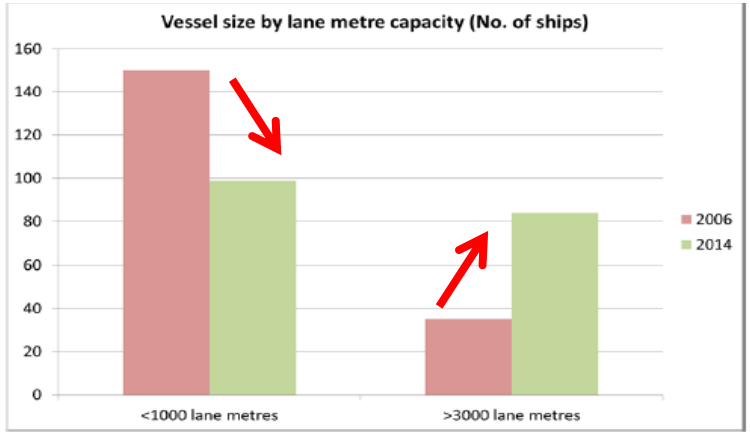
2 Shortsea modes of transport

LoLo (MPP/HL)



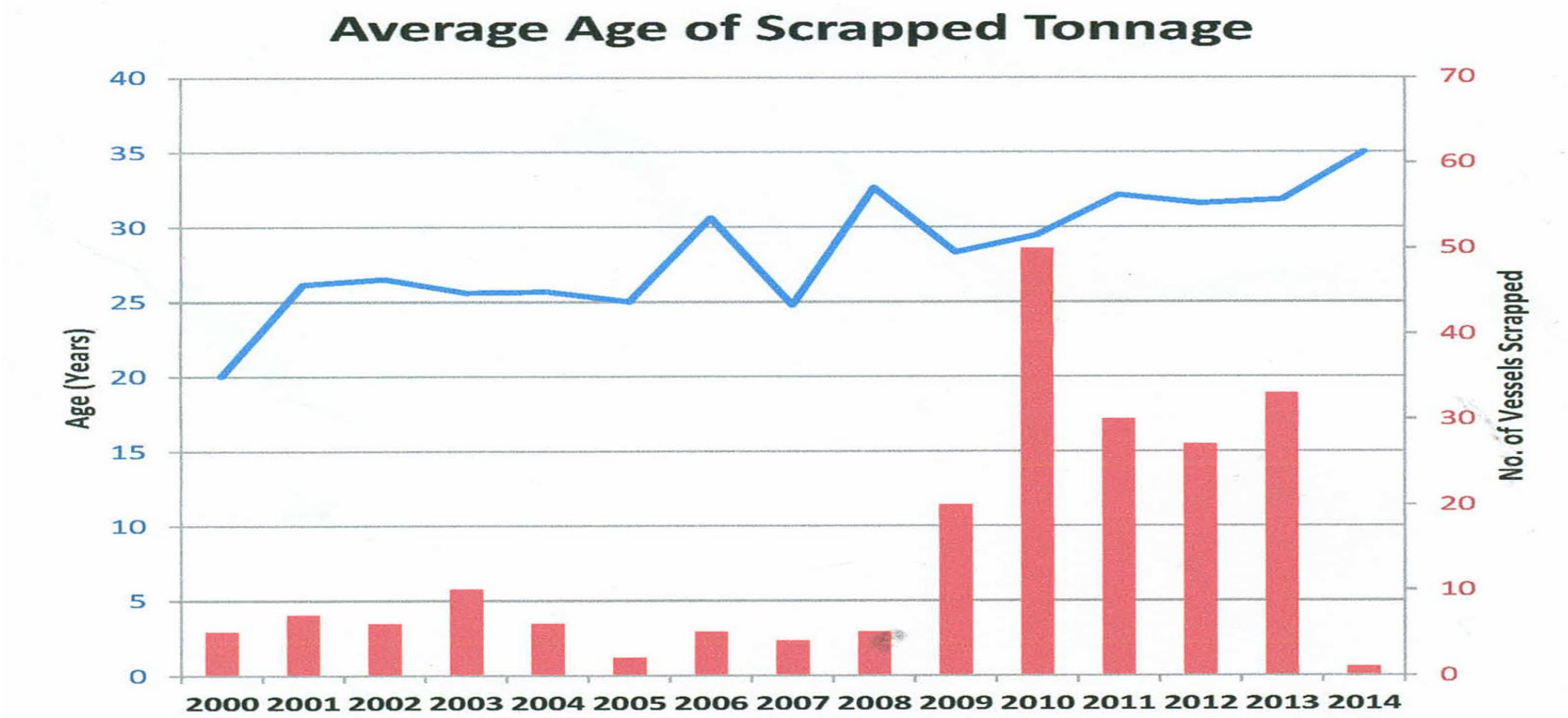
RO/RO cargo





Source: Clarksons Shipping Intelligence, IHS Fairplay, and MDST Databank

RO/RO trends



Ro-Ro Fleet	Free Height 6.5m	Free Height 10.5m
Number of Ships	49	3

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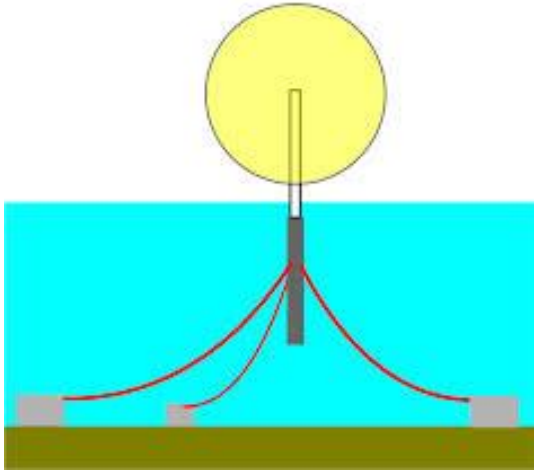
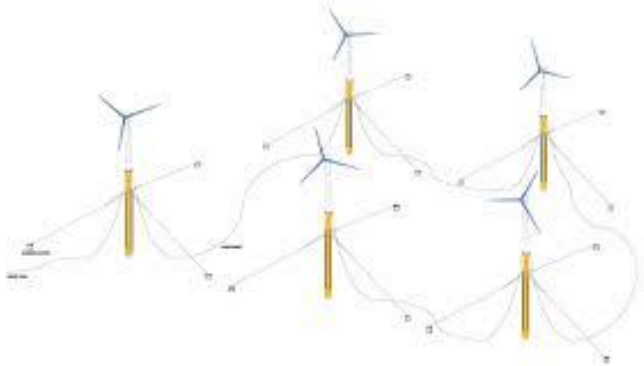
Source: Navitaship, Clarksons

And what about…

Floating turbines…

- Installation?
- O&M?





Groups on innovation
- technology vs logistics/shipping

Group #1	**WTG**
Group #2	**Foundations**
Group #3	**Floating wind turbines**

3 groups

Please nominate:

- Captain
- Time-keeper
- White board note taker
- Presenter

Please be ready to:

- Provide an answer
- Explain your discussions
- Review your findings on the flip-chart

The groups

#1 Christian, Jesper, Per K, Johan

#2 Henning, Mads, Søren, Per C

#3 Thomas (SWP), Jan, Chris, Peter

Please be back at...

15:07 PM

(Please include the coffee break)

Presentation of group results

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Presentations

Flip-chart presentations from the 3 groups

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Academic update

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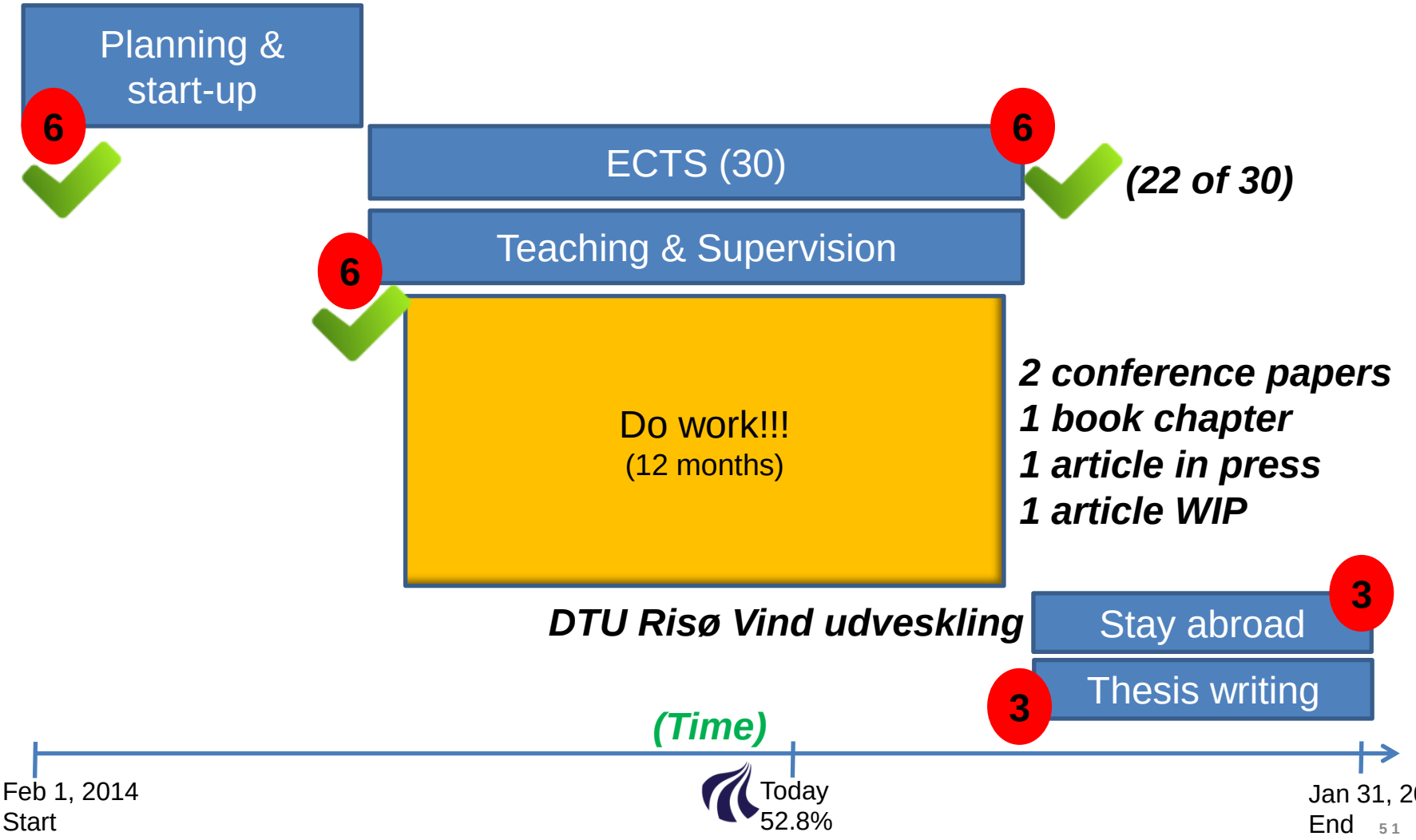
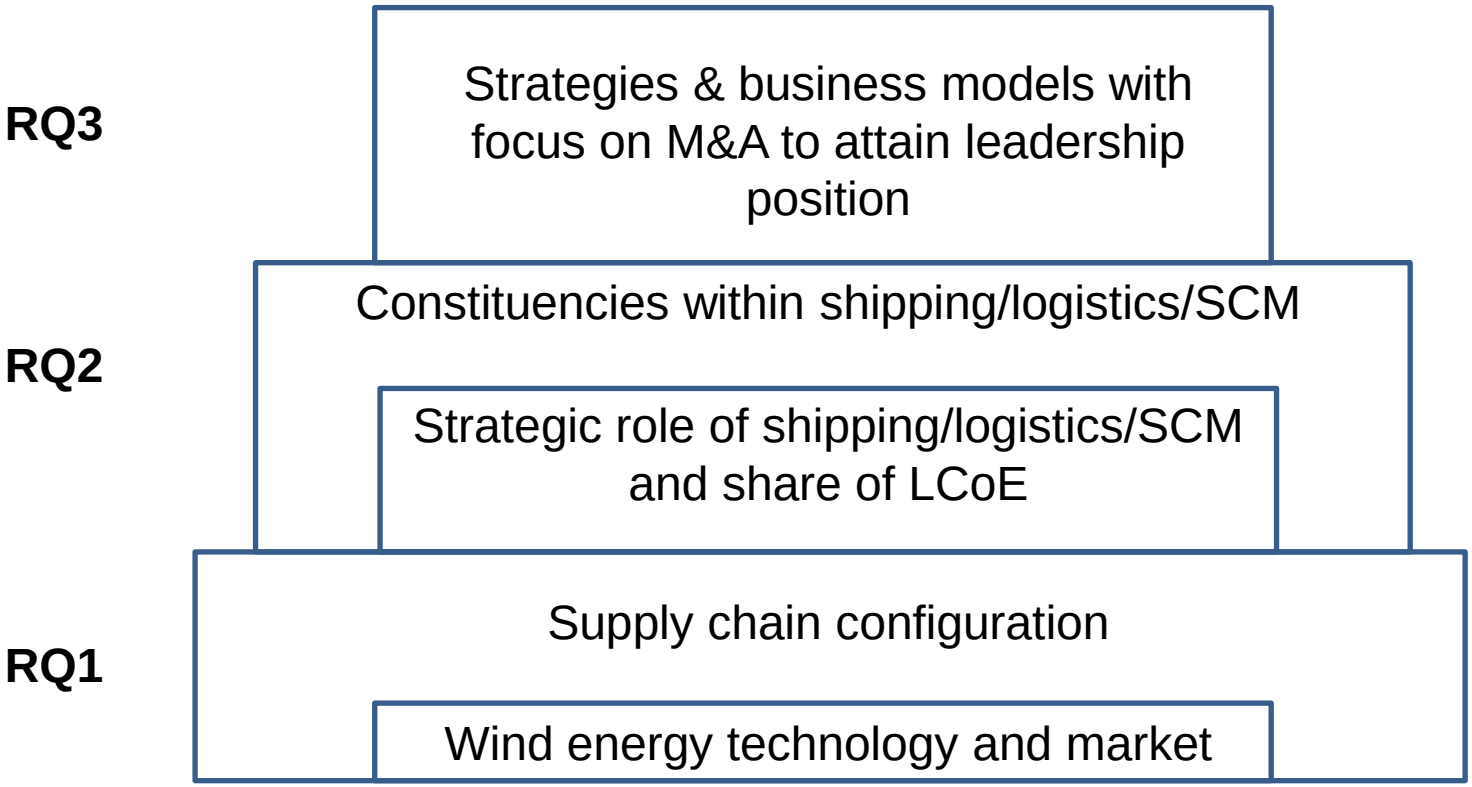
Time blocks of Ph.d. (3 years)



Tiered research questions



3 scientific research questions

I. Wind energy product technology development, market, and supply chains:

How do development in products technology (size, weight, structure/modularization), life cycles and market features (geographies, sizes, segments, national regulation, etc.) determine targets, strategies, and configurations of wind energy supply chains?

3 scientific research questions (cont.)

II. Strategic role of shipping and logistics in the supply chain:

How can shipping, logistics, and SCM activities contribute to the realization of targets and strategies for wind energy supply chains, and what is their share of LCoE?

3 scientific research questions (Cont.)

III. Wind shipping, logistics, and SCM competitive leadership:

What competitive-, partner-, and operational strategies are viable for supply chain constituencies to attain a leadership position in local, regional and/or global wind energy shipping, logistics, and SCM markets?

Final thesis ToC

- Summary
- Introduction and background
  - ✓ Status of knowledge indicating scientific context
- Theoretical framework
  - ✓ Different per article
- Methodology
  - ✓ Flyvbjerg on misunderstandings about case studies

Final thesis ToC (cont)

- Short summary of each article
  - ✓ Incl. rød tråd og ”fit”
- Results seen as a whole
  - ✓ På tværs af de enkelte artikler
  - ✓ I forhold til 5 forskningsspørgsmål
- Conclusion
- References

Wrap-up and close

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Closing of today

- Date
- Hosting company
- City

✓Wrap-up

Next Reference Group meeting

Date suggestion: March, 2016

Any volunteers?

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Transfer to gå-hjem

Now let us proceed to room 230-231