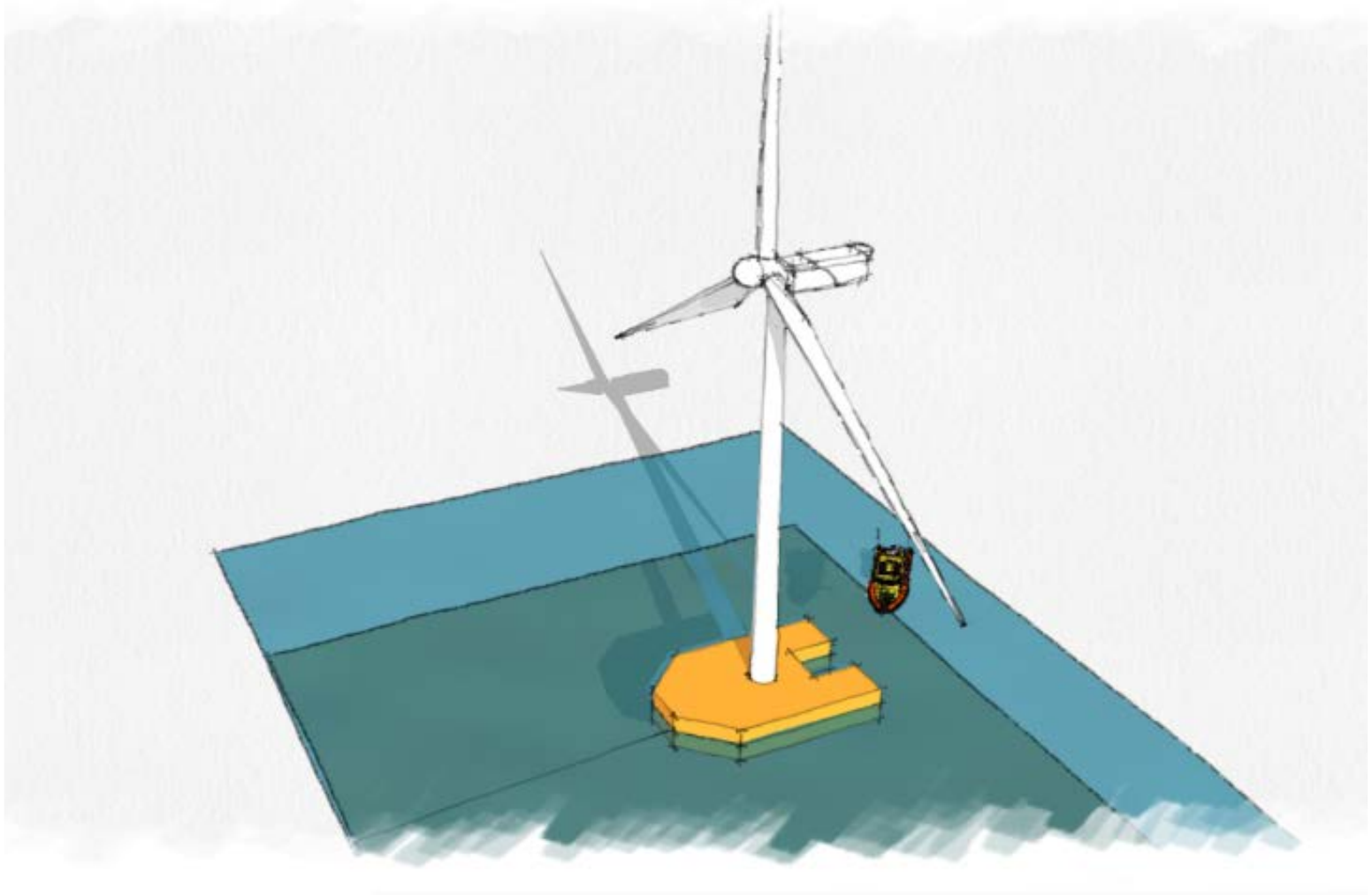

WINDBARGE

EERA DeepWind'18

WindBarge - Floating wind production at intermediate water depths



Reduce cost:

Easy to build
Easy to install
Maintain and decommission

TEAM

Jørgen Ranum Krokstad

Inventor, Prof II at Dep. Marin Technology. 32 yr. of experience in hydrodynamic and wind

Synne Nybø

M.S.c in offshore construction from Dep. Marin Technology. Research on fatigue and global analysis of WindBarge

Jan Tore Horn

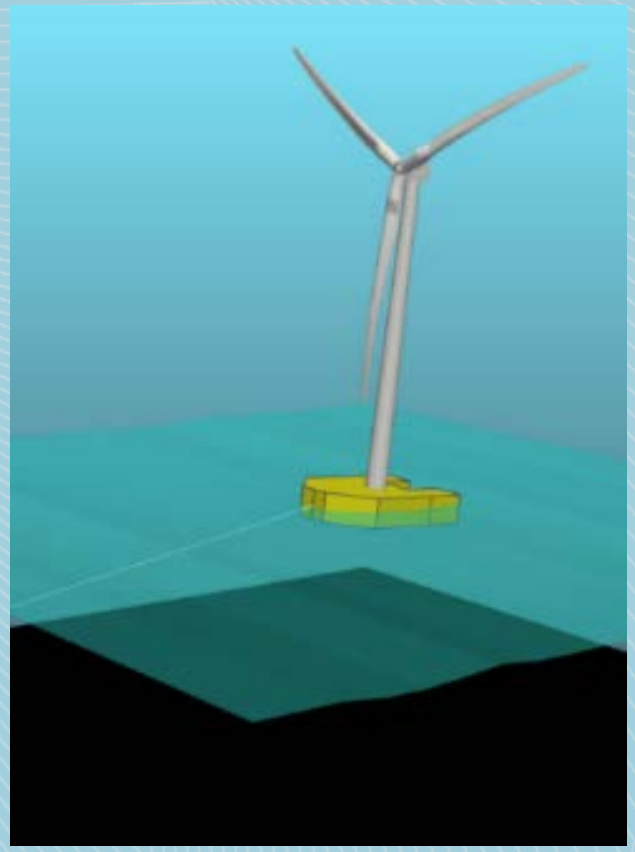
PhD at Dep. Marin Technology. Focusing on hydrodynamics and reliability.

Fredrik S. Moen

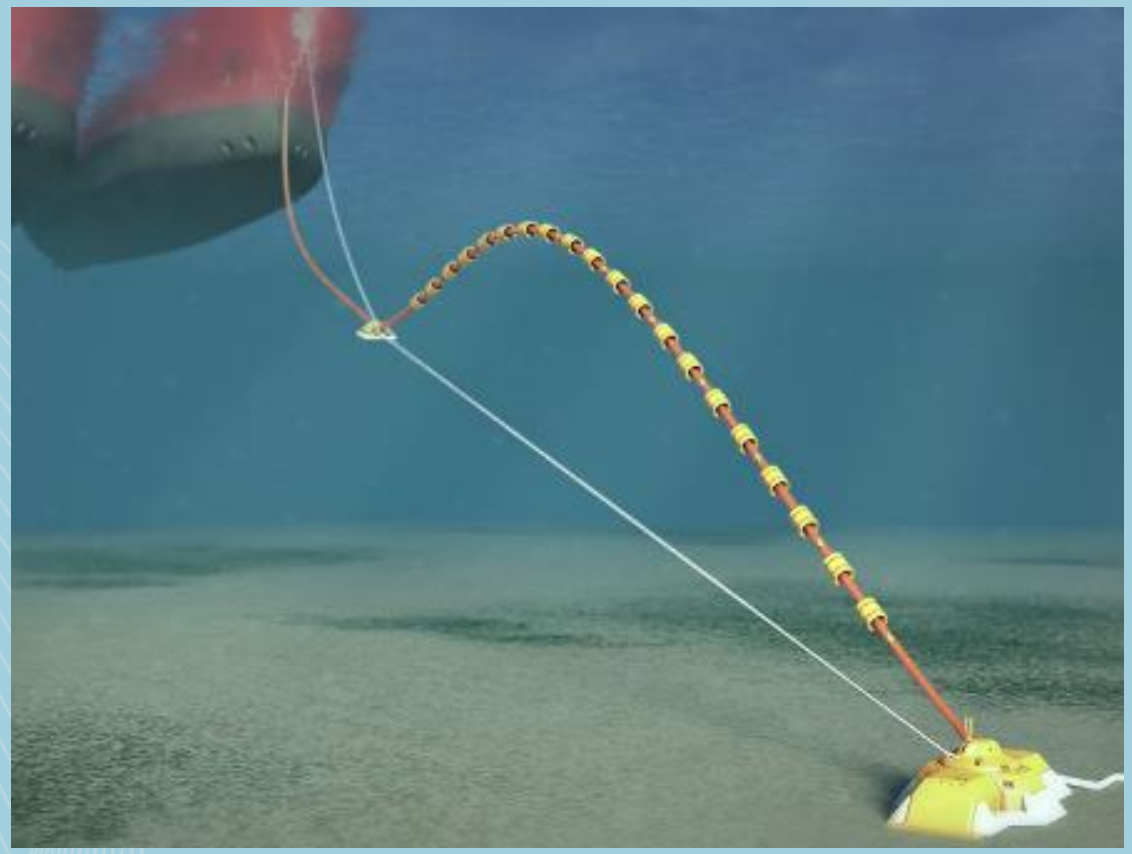
Project Manager
International rig management and shipyard experience

NTNU
Det skapende universitet

Single line mooring and weathervaning

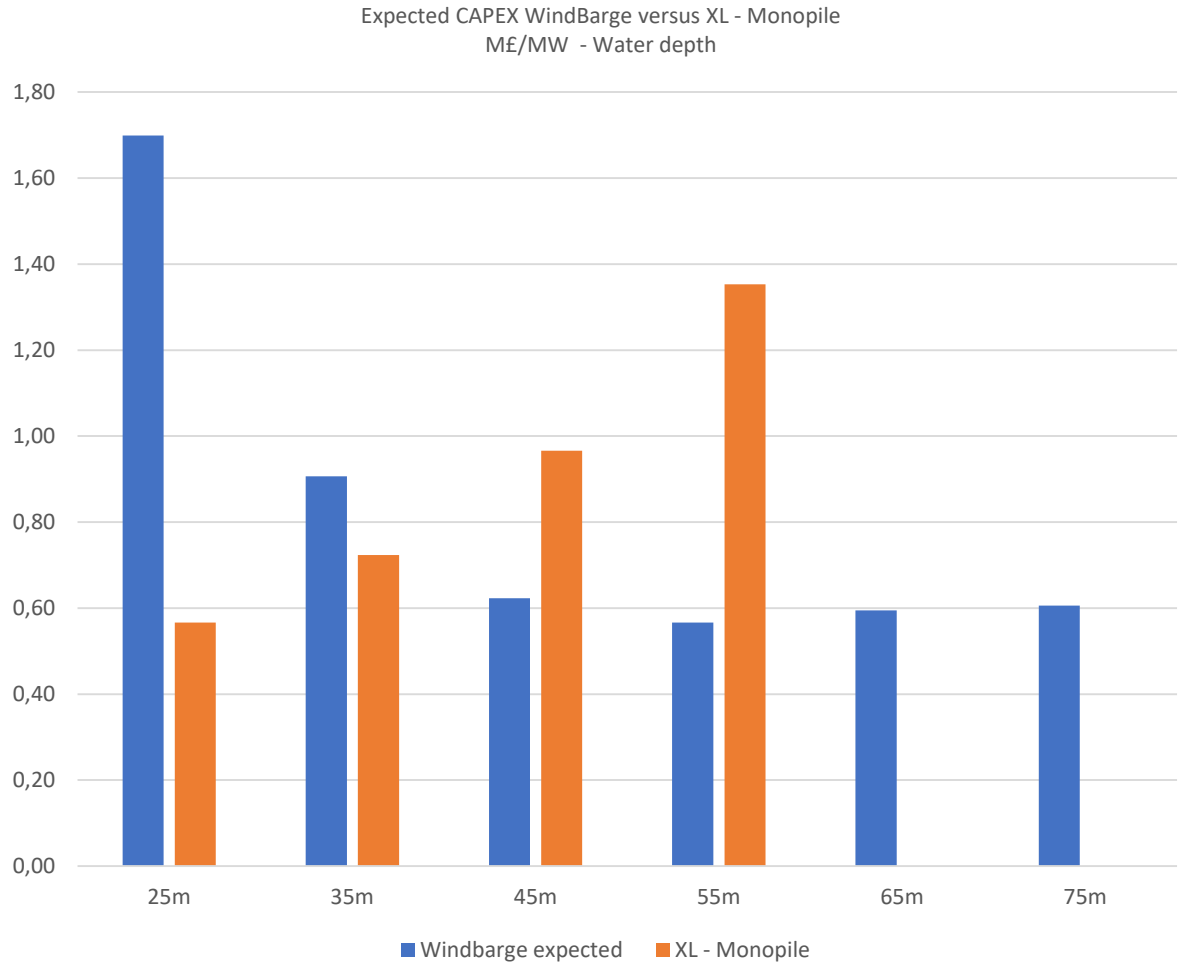


No pretension
No swivel
Redundancy
Position kept by using yaw controller
Known principle
Standard turbine



WindBarge

- **Floating** wind barge – easy to **install**, **maintain** and **decommission**
- **Water depths 40 – 100 meter**
- Large marked within existing **farms**
- Possible to compete with fixed **monopile foundations**: more **environmental friendly** and **lower cost**
- **Low draft** - built in standard harbors or docks
- **Increased production**



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Steel mass ratios compared with competitors

Reference monopile

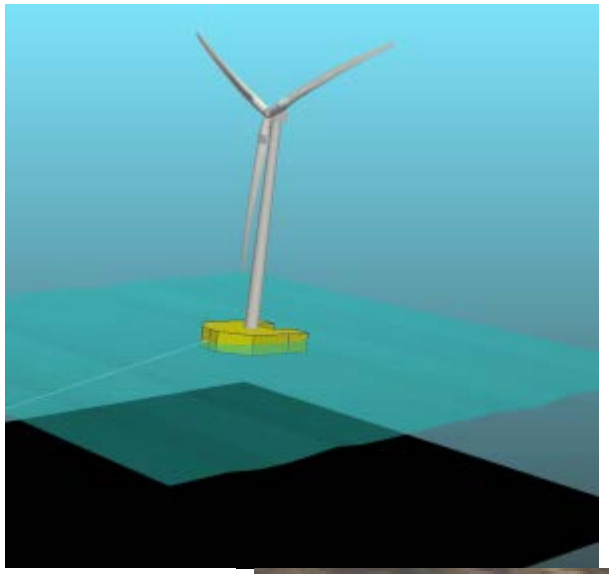
- Turbine Vestas 164 - 8 MW
- **Mass/MW ratio monopile = 244**

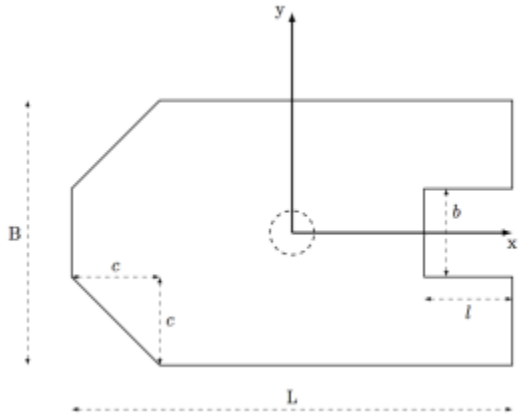
WindBarge 8 MW

- Turbine Vestas 164 - 8 MW
- **Mass/MW ratio WindBarge = 238**

WindBarge – Sheltered access

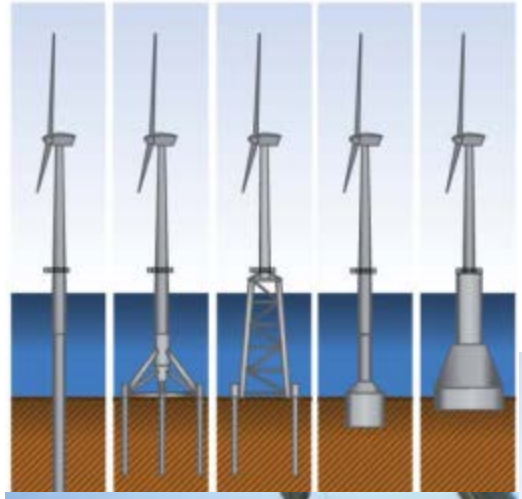
- **Sheltered access** in the stern of the floater for maintenance vessels (example ESNA – daughter ship (SES))
- Increased weather window
- Target 2.5m Hs

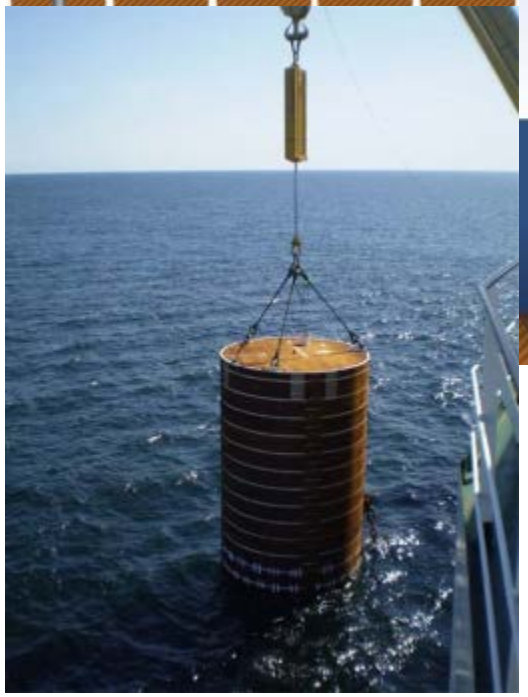


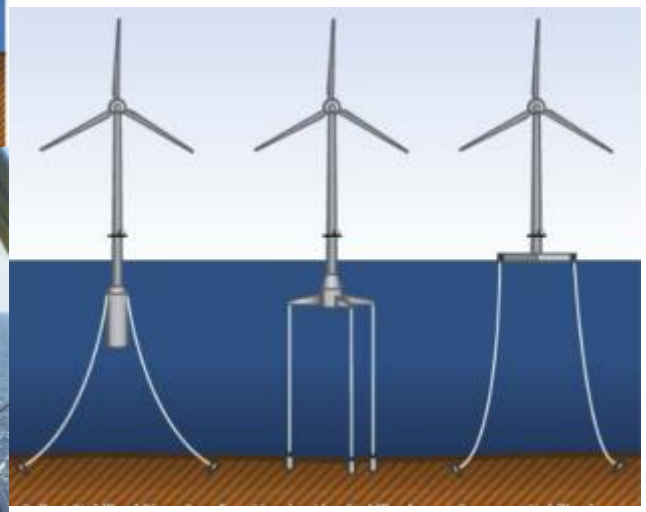


Suction anchor – not new to the wind industry

- High vertical load capacity
- Safety factor of 2 ->
  6 MN vertical load
- Anchor mass in order of 100 tonn
- Towing installation method







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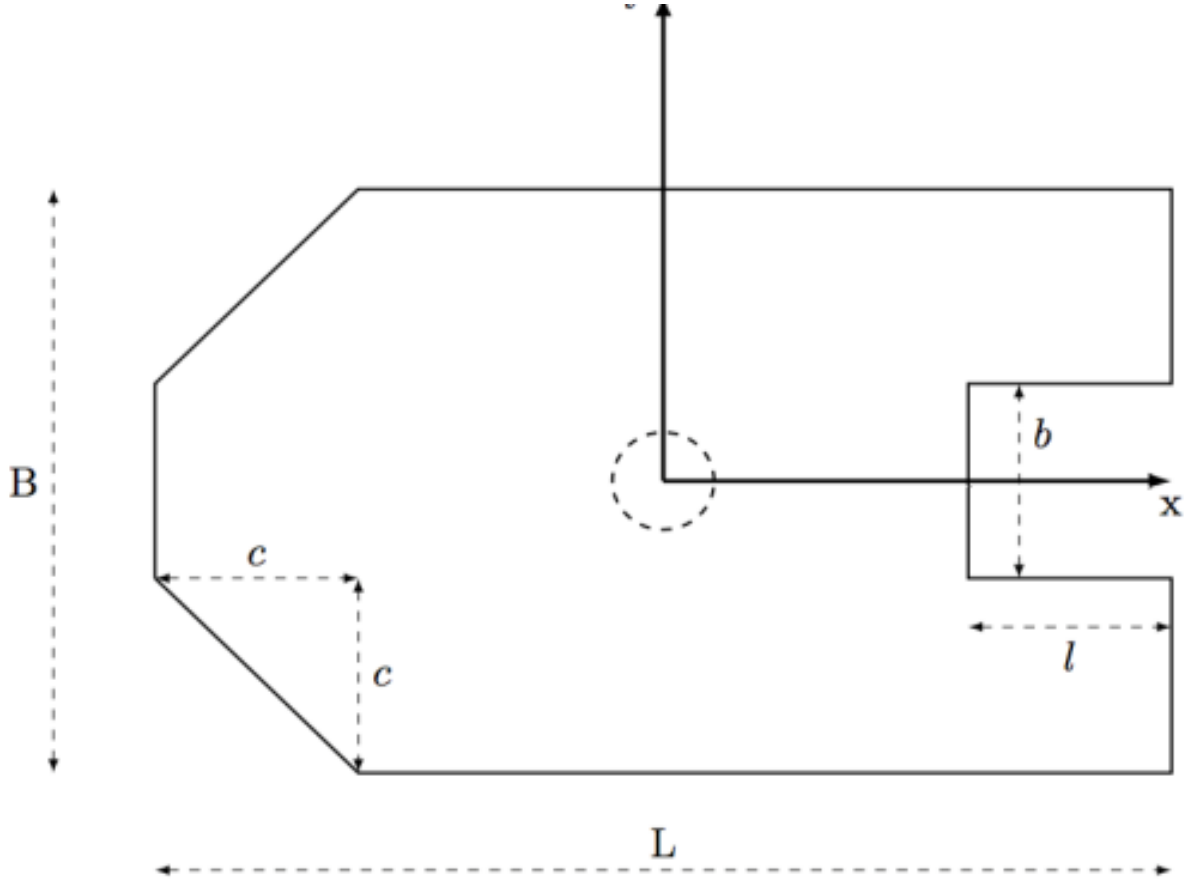
Main dimensions – 5 MW version (could be scaled to 8 MW – estimated 1700 ton steel)

Natural Periods

- Heave 7s
- Pitch 17s
- Roll 24.4s



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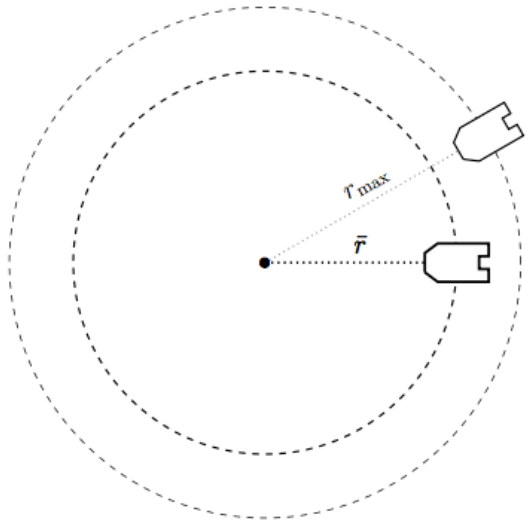
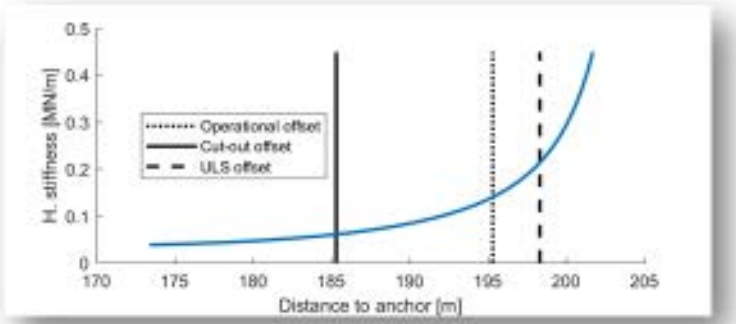
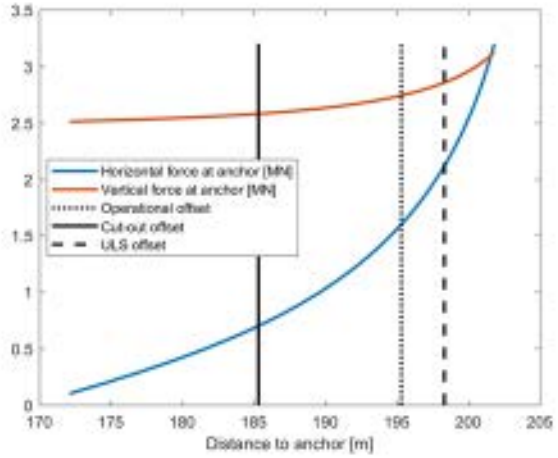
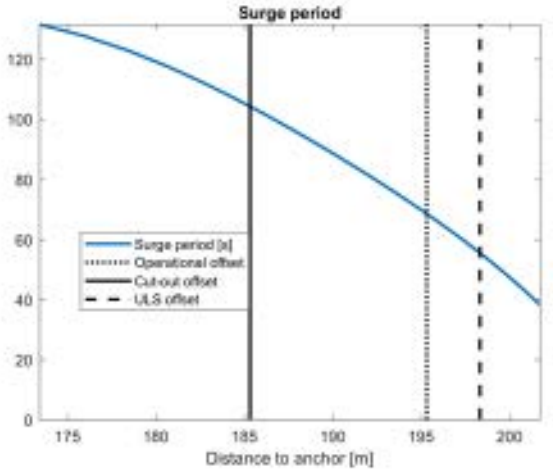
Single Mooring Line (SML – system)

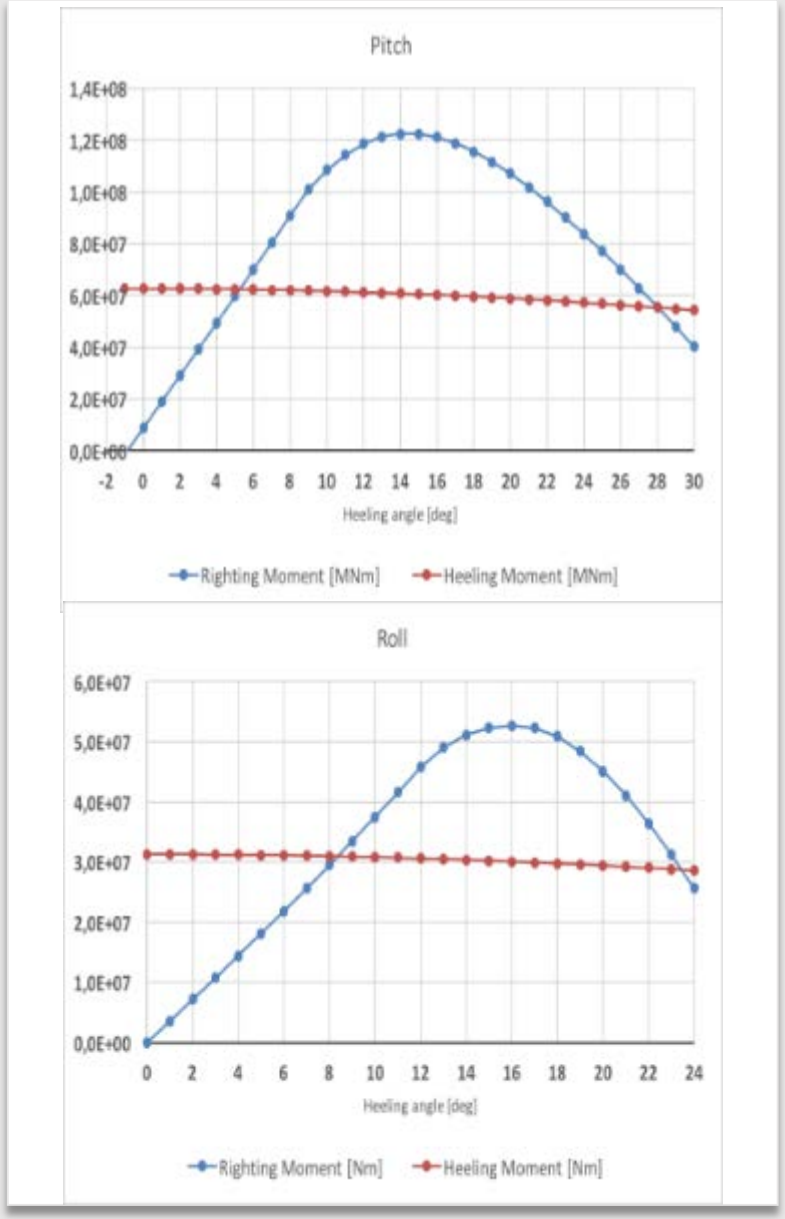








Accept criteria	Comments	Status
Intact stability	DNV OS-J103. Different in roll/pitch due to weather vaning.	OK
Restoring moment	Max mean pitch angle < 5 deg	OK
Nacelle acceleration	RMSE < 0.2g , MPMV < 0.6g	OK
High pitch-period	Maximized during optimization	OK
Yaw stability	Avoid fishtailing and maintain heading passively/actively	In progress
Mooring system	Single mooring line with buoys and electrical cable + suction anchor for unobstructed rotation	Initial design
Turbine support	5-8MW	OK
Maintenance access	Sheltered docking < 2.5m Hs	Not verified
Structural capacity	Wave- and wind bending moments within the capacity of a simple barge design	In progress
ULS simulations	Verify barge behavior in extreme conditions	In progress
FLS simulations	Long-term FLS analyses with SCFs – find damage equivalent loads	Not started



Intact stability

- DNV requirements satisfied in pitch.
- In roll, it is assumed that 50% of the capacity is sufficient due to limited wind overturning moment.

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Planed Projects

BOA offshore

DEEP SEA MOORING
A VRVHOF COMPANY

NTNU
Institutt for marin teknikk

Norconsult

Statoil

- Verification from simulations/model tests
- General design improvements
- Technology qualification
- LCOE – documentation

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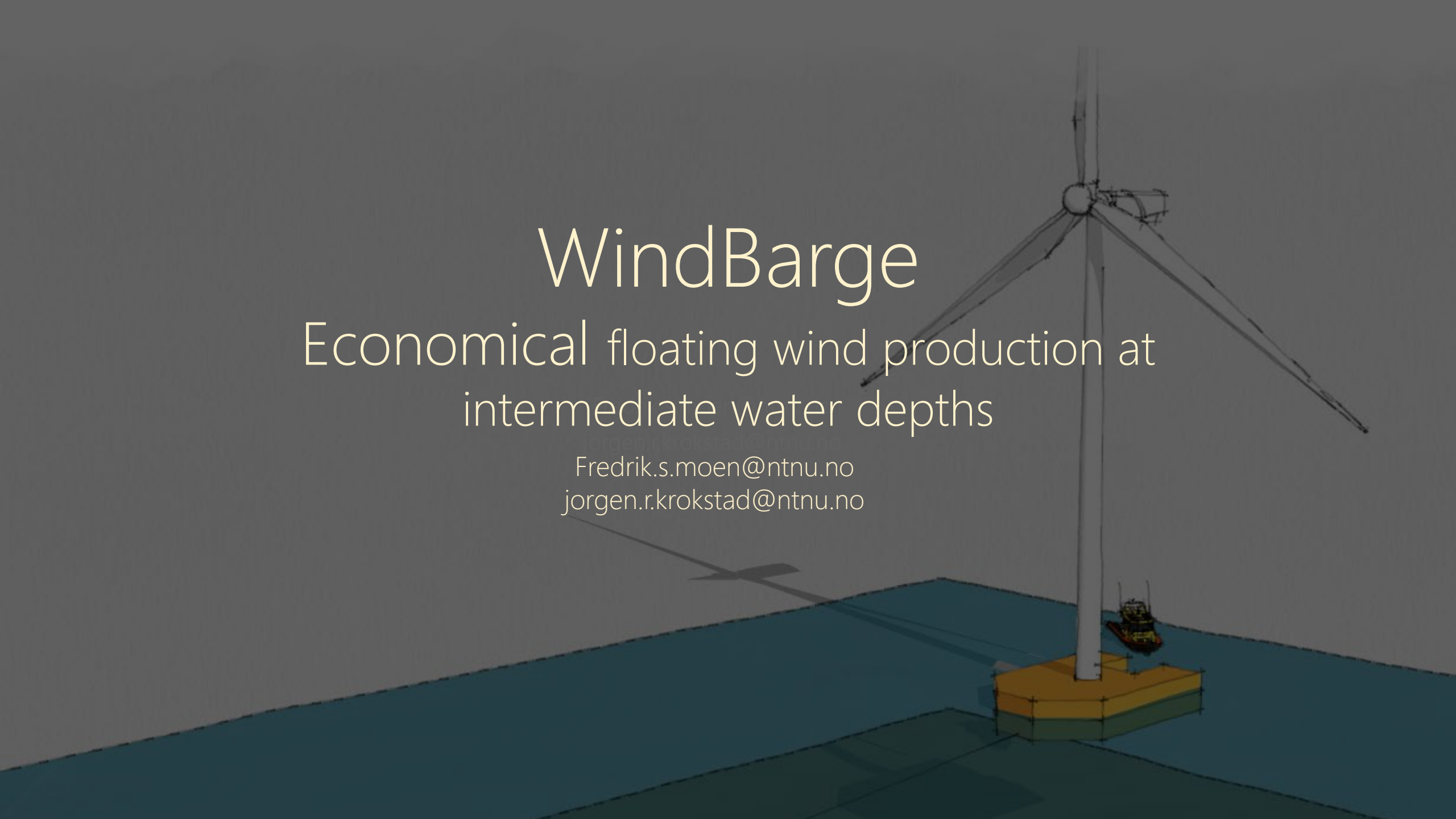
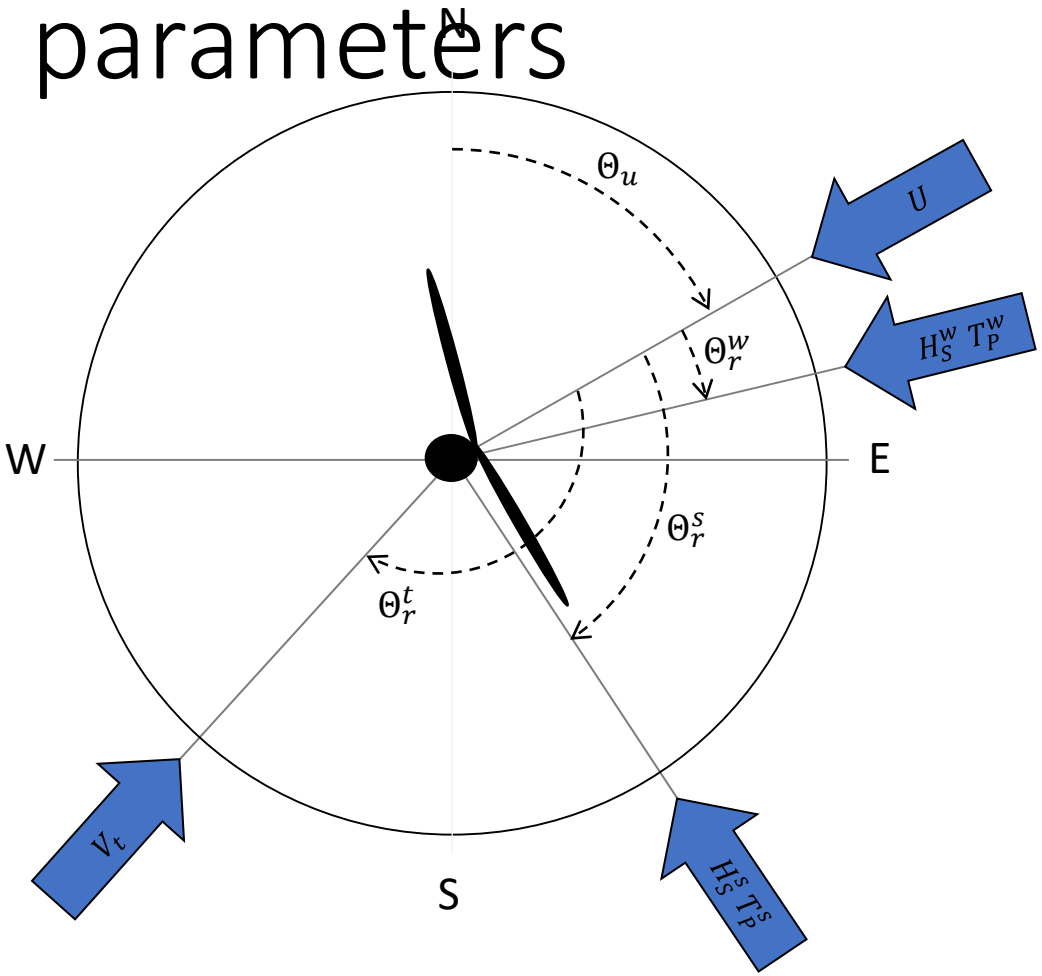


WindBarge

Economical floating wind production at intermediate water depths

jorgen.r.krokstad@ntnu.no
Fredrik.s.moen@ntnu.no
jorgen.r.krokstad@ntnu.no

Metocean parameters



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