Universität Rostock Traditio et Innovatio

LWE7 STIFTUNGSLEHRSTUHL WINDENERGIETECHNIK

A Modular TLP-Design for Offshore Wind Turbines

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Personal Introduction

- since 2016 Research Associate @ LWET

  Floating Offshore Wind Turbines, Coupled Simulations, Hydrodynamics, Structural Design

- 2015 - M.Sc. (Civil Engineering) @ TU Braunschweig

  Geotechnical Engineering, Steel Engineering, Hydromechanics and Coastal Engineering

- 2012 - B.Eng. (Civil Engineering) @ TH Nürnberg

  Hydromechanics, Renewable Energies and Environmental Technologies

Content

Motivation

Figure: Windparks in northern Europe I source: 4coffshore.com

Motivation

Why do we need floating substructures in Germany?

- Application for Bottom-fixed solutions are limited
- Germany is an export oriented economy
- The world wide demand for clean energy is huge
  - Desalination
  - Power-to-X
  - Growing Population
  - Floating Oil Rigs

We can support the blue growth world-wide with our experience and our technologies.

Content

Floating Substructures

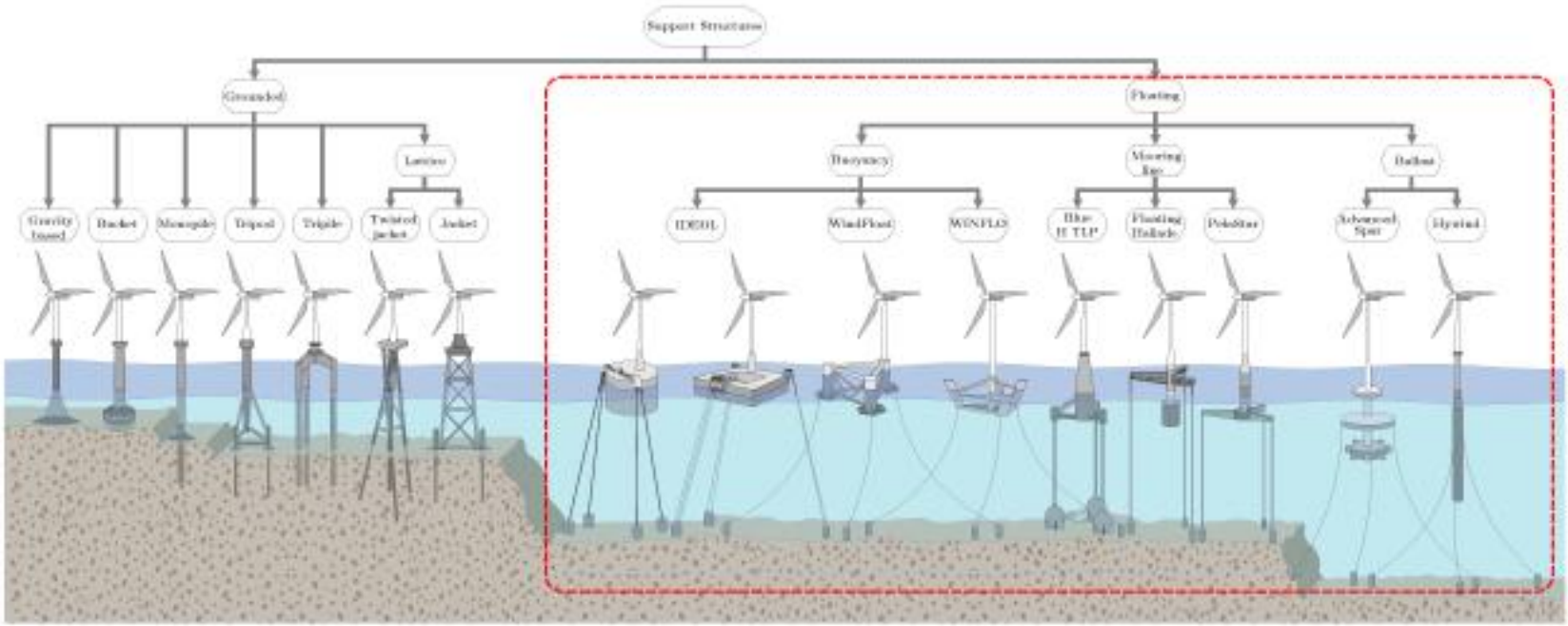


Figure: Floating substructures| source: Silvio Rodrigues et al.

Floating Substructures - Semi Submersible

Pros:

- Shallow draft
- Adaptive design

Cons:

- Controller modifications necessary
- Time consuming build
- Cost intensive dry dock rent
- huge docks needed
- Competitors: Shipbuilders

Figure: WindFloat in dry dockl source: Cermelli / Principle Power Inc.

Floating Substructures - Spar

Pros:

- Very slender design
- easy to build

Cons:

- Controller modifications necessary
- Big draft
- Deep waters needed
- No one-step installation
- Cost intensive special crane ship

Figure: Hywind Scotland - Matingl source: Ørjan Richardsen / Woldcam/Statoil

Floating Substructures - TLP

Pros:

- Very rigid foundation
- Arbitrary turbine possible
- No customization of controller necessary
- Slender structure
- Slight draft

Cons:

- Complex installation procedure
- Special installation vessel needed

Figure: Iberdrola Installation Vessell source: Juan Amate / Iberdrola Ingeneria y Construccion

Content

GICON-SOF

- Prefabrication of modular members off site
- Steel or concrete for the members is possible
- Transportation to the assembly site
- Assembly using e.g. bolted connections

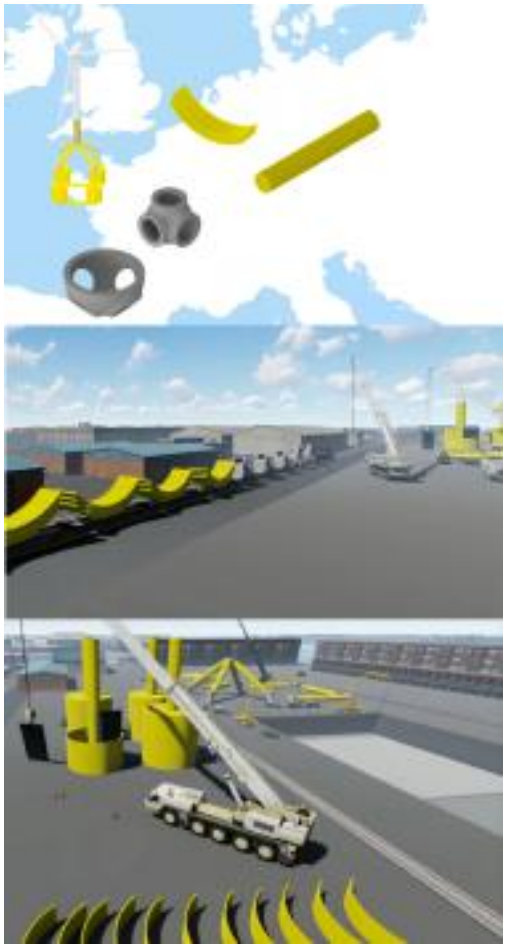


Figure: GICON-SOF - Assembly and Installation

GICON-SOF

- Fabricating the anchor by use of in-situ concrete and prefabricated elements
- Completing of the SOF on top of the gravity anchor
- Tow-out of the substructure including gravity anchor

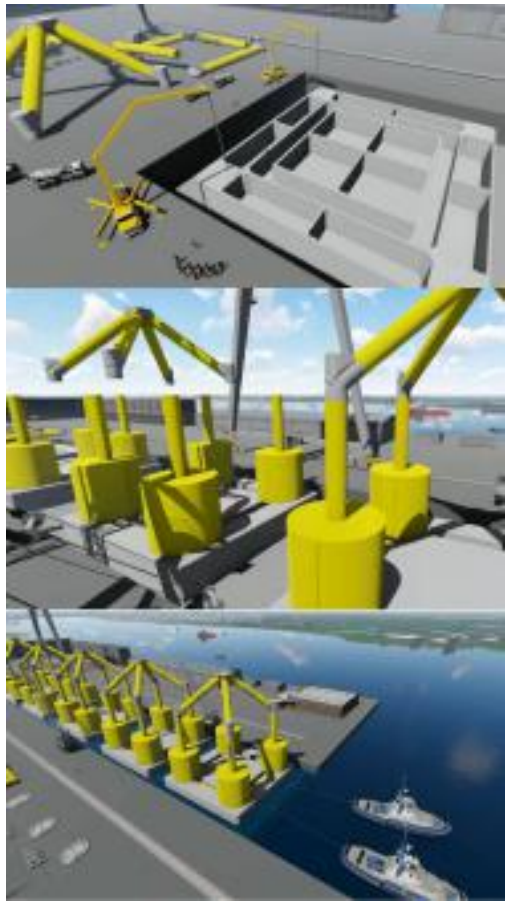


Figure: GICON-SOF - Assembly and Installation

GICON-SOF

- Assembly of the WEC on top of the SOF
- Towing of the entire structure to the commissioning site
- Lowering and ballasting of the anchor
- Lowering of the SOF
- Enable grid connection

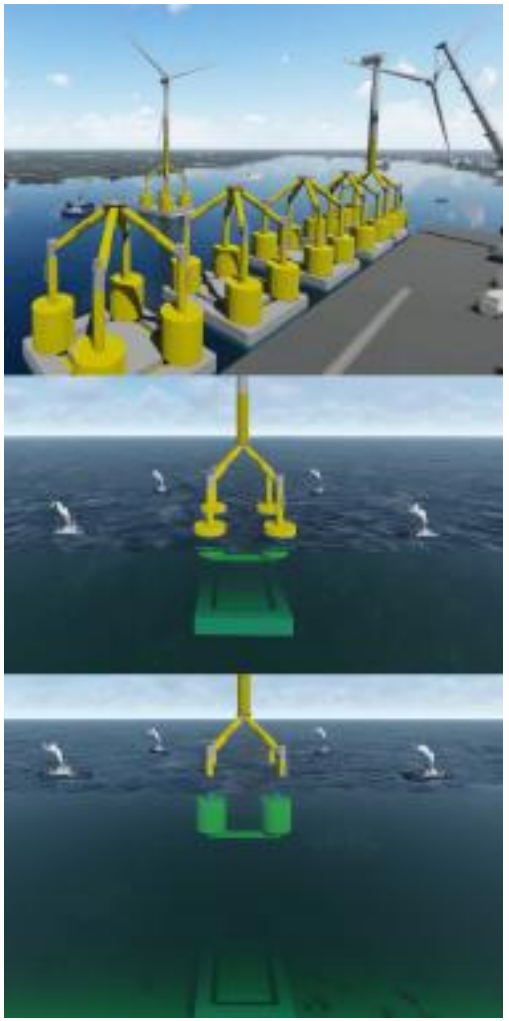


Figure: GICON-SOF - Assembly and Installation

GICON-SOF

Pros:

- Modular and adaptive design -> low assembly time
- One-Step installation
- Very rigid foundation
- Design for arbitrary turbines
- No customization of controller
- No special operation vessels
- No 'tricky' offshore operations
- Comparable slender structure
- Slight draft

Challenges:

- Sealing between members
- Strategy for mooring failure

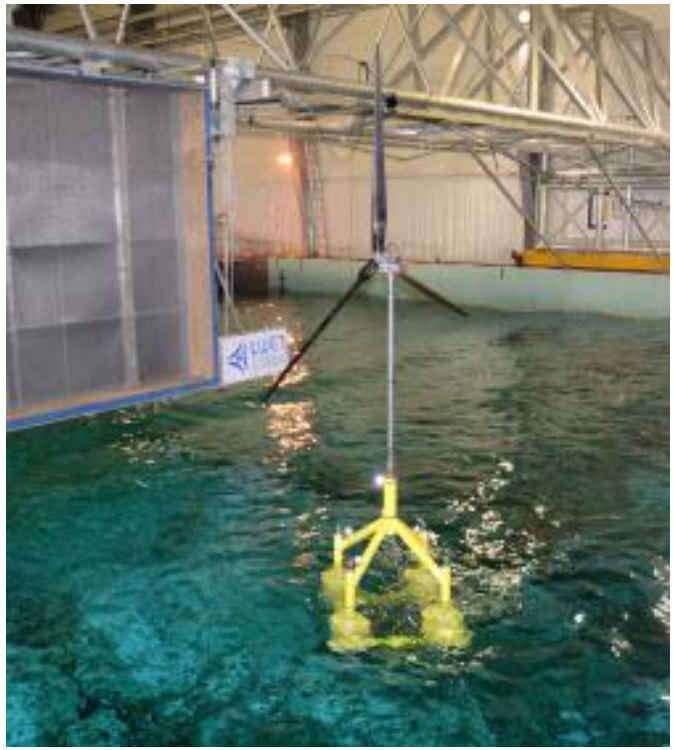
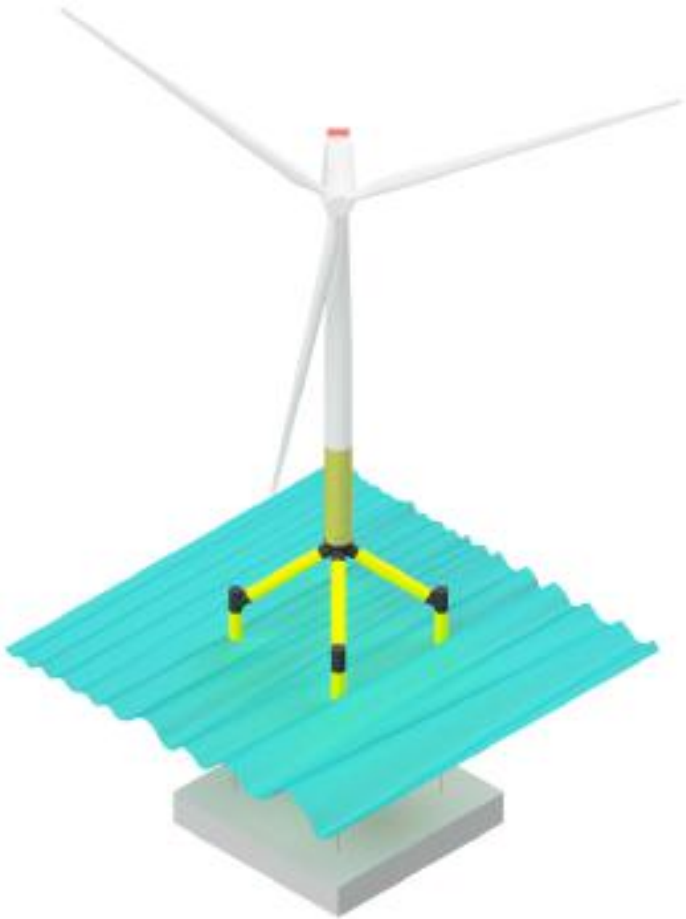


Figure: Tanktests of the GICON-SOF at Ecole Central Nantes

Contact



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