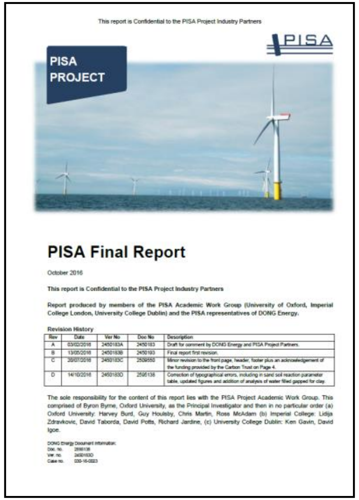
Offshore Wind Energy

Professor Byron Byrne FREng FICE

Ørsted / Royal Academy of Engineering Research Chair

University of Oxford



This report is Confidential to the PISA Project Industry Partners

PISA PROJECT

PISA Final Report

October 2016

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Report produced by members of the PISA Academic Work Group (University of Oxford, Imperial College London, University College Dublin) and the PISA representatives of DONG Energy.

Revision History

Rev	Date	Ver No	Doc No	Description
A	03/02/2016	2450183A	2450183	Draft for comment by DONG Energy and PISA Project Partners.
B	13/05/2016	2450183B	2450183	Final report first revision.
C	20/07/2016	2450183C	2509550	Minor revision to the front page, header, footer plus an acknowledgement of the funding provided by the Carbon Trust on Page 4.
D	14/10/2016	2450183D	2595138	Correction of typographical errors, including in sand soil reaction parameter table, updated figures and addition of analysis of water filled gapped for clay.

The sole responsibility for the content of this report lies with the PISA Project Academic Work Group. This comprised of Byron Byrne, Oxford University, as the Principal Investigator and then in no particular order (a) Oxford University: Harvey Burd, Guy Houlsby, Chris Martin, Ross McAdam (b) Imperial College: Lidija Zdravkovic, David Taborda, David Potts, Richard Jardine, (c) University College Dublin: Ken Gavin, David Igoe.

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10th Annual Oxford Energy Day: “Energy and Net Zero”

Wednesday 23rd March 2022

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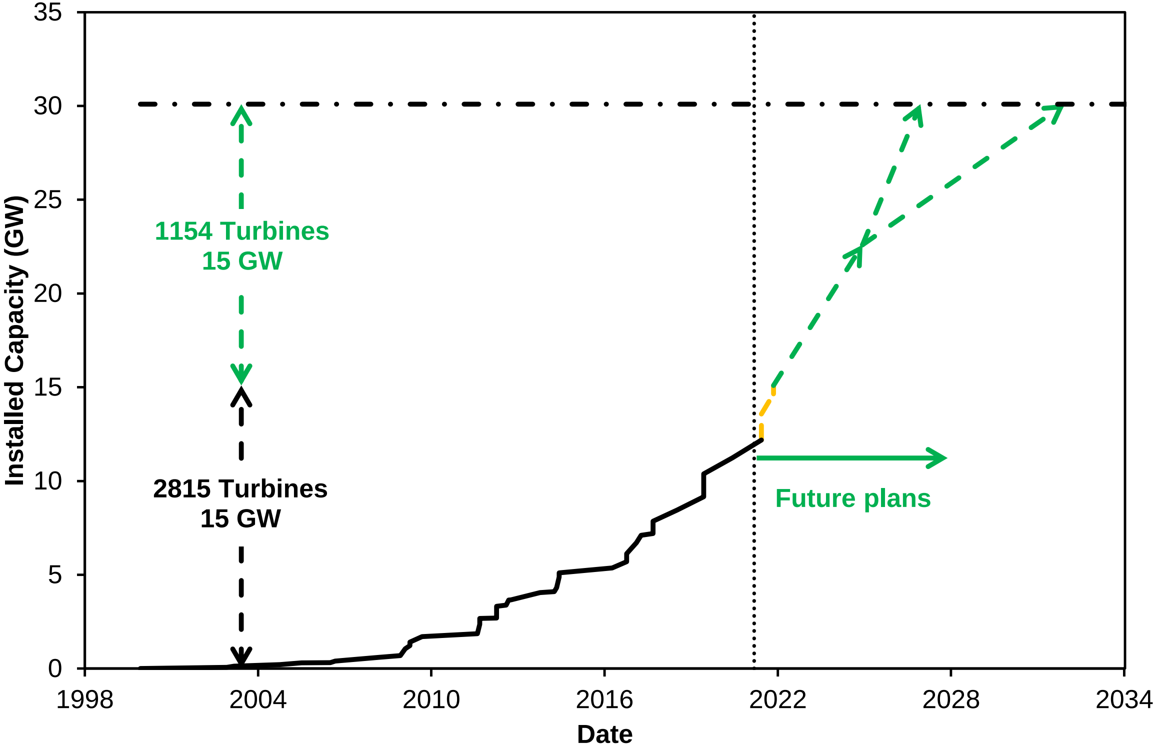
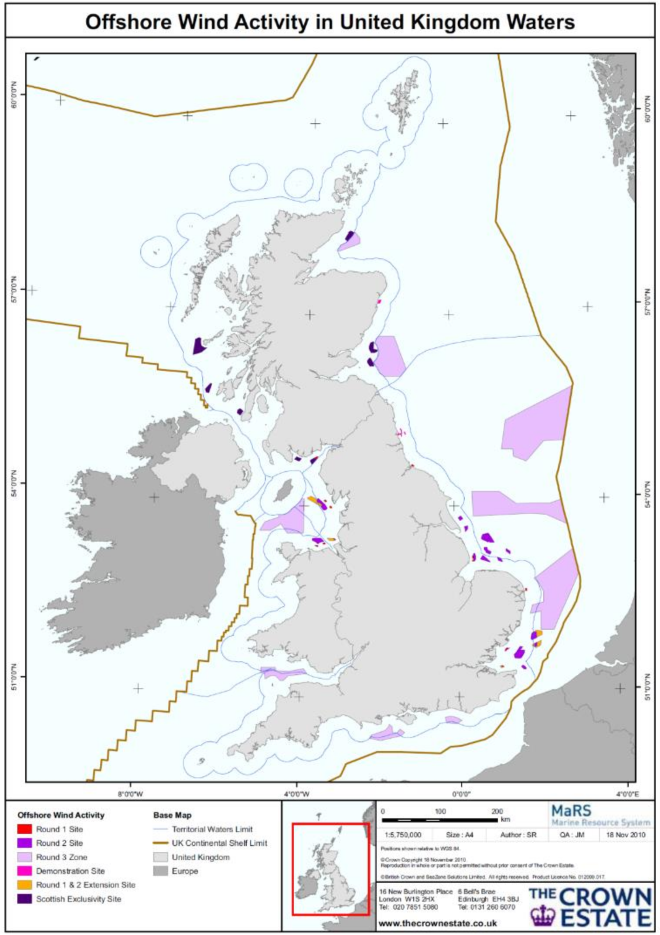
UK Ambition





Source: The Crown Estate

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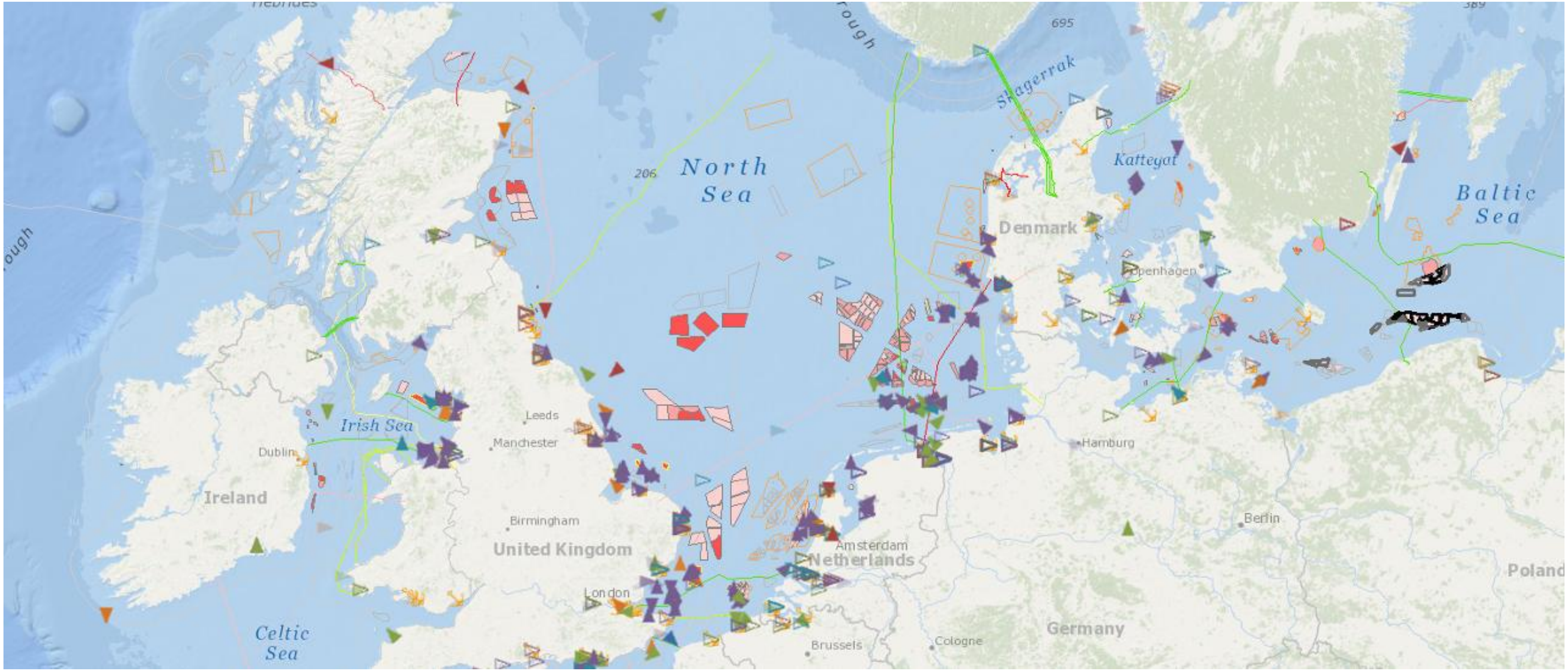
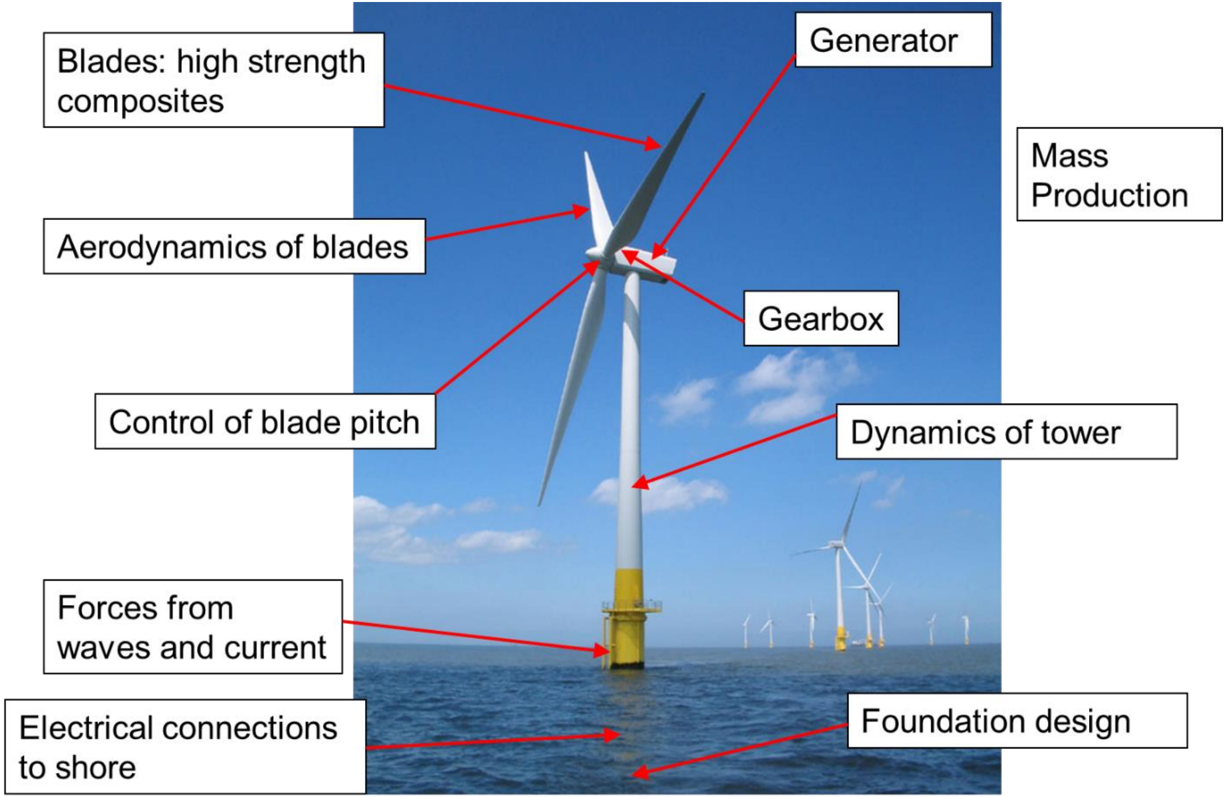
Offshore Wind Map – 4COffshore



Source: 4COffshore.com

Engineering for Offshore Wind Turbines



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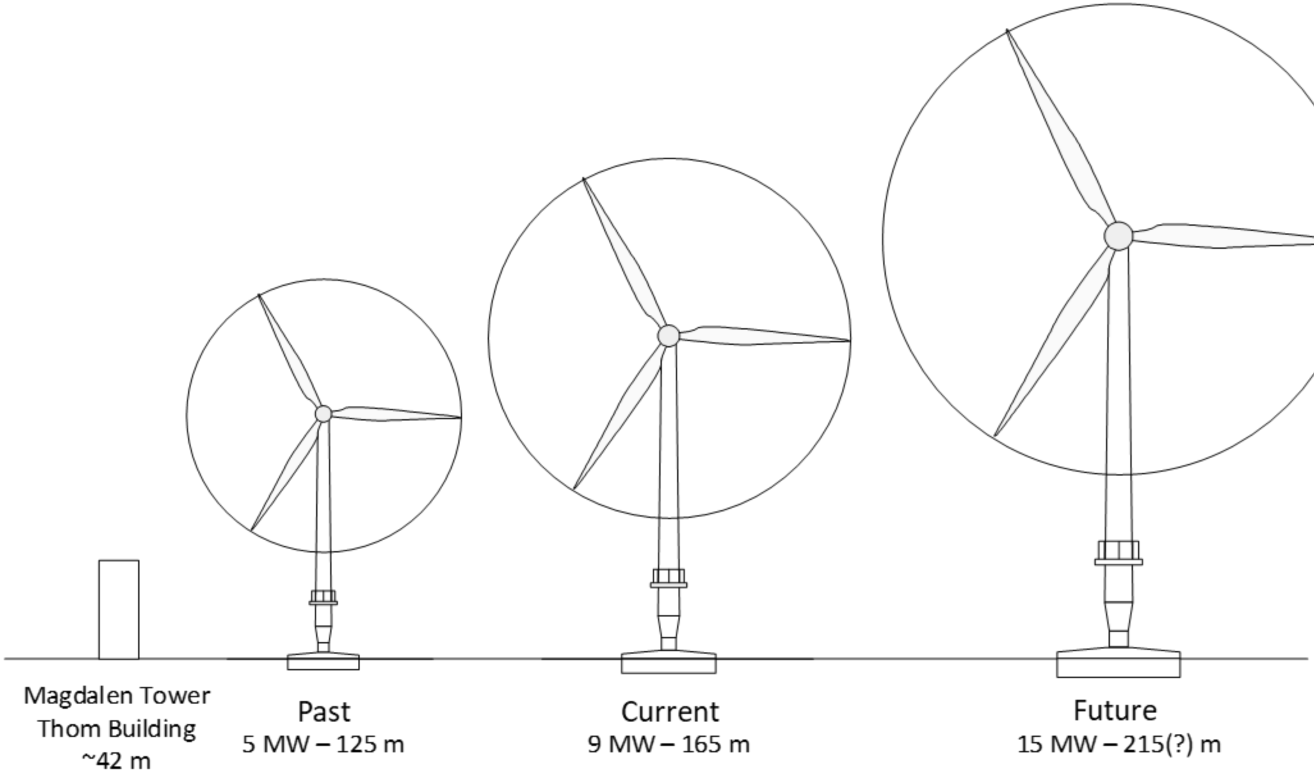
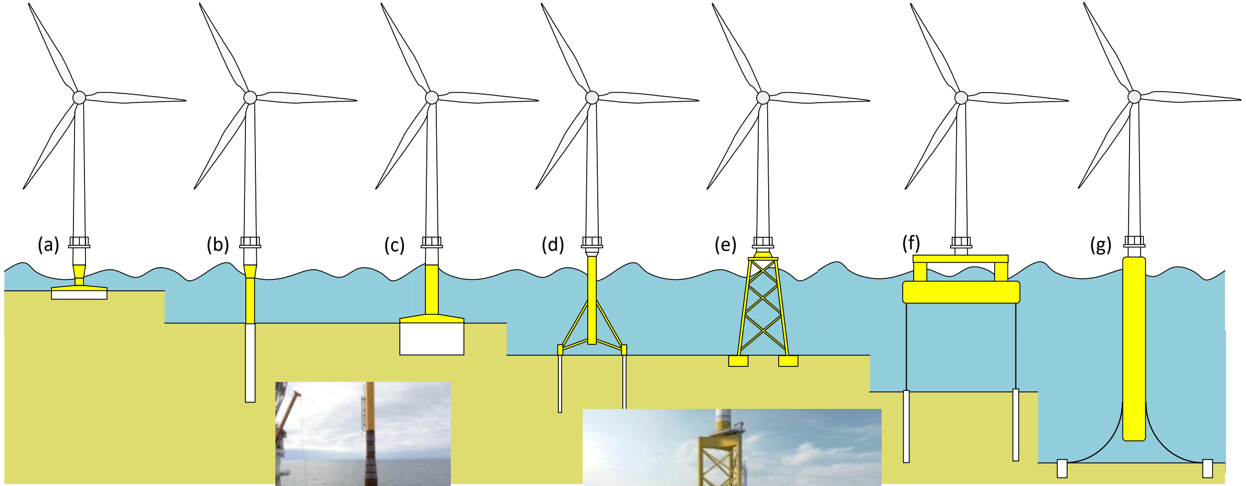
Scale of Engineering Design



Offshore Wind Structures



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Images from various websites

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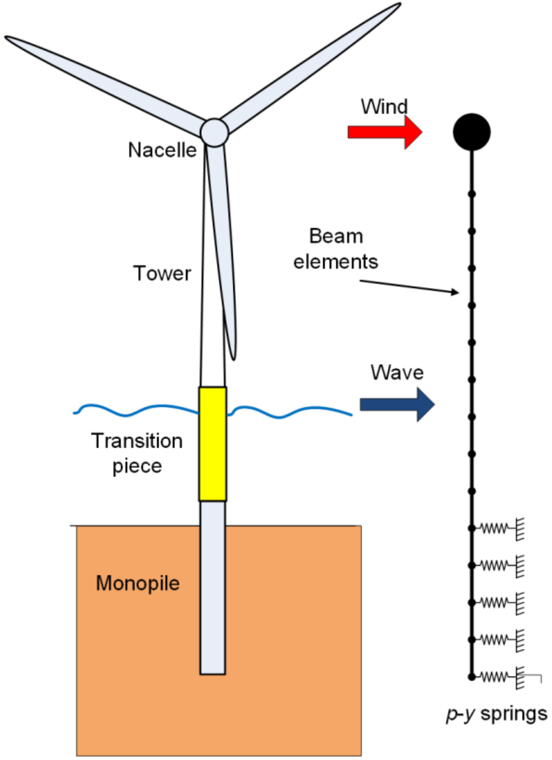
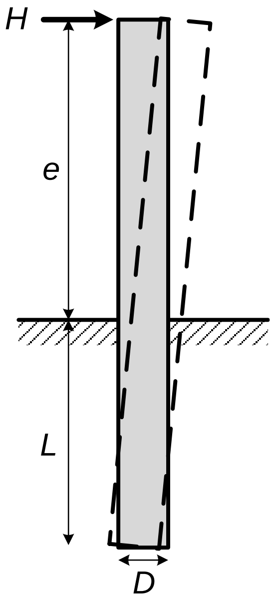
Oxford Focus on Monopiles



L/D = 2 to 6
e/D = 5 to 15
D > 10 m



University of Oxford

Photos from Dan Kallehave (Ørsted)

Royal Academy of Engineering

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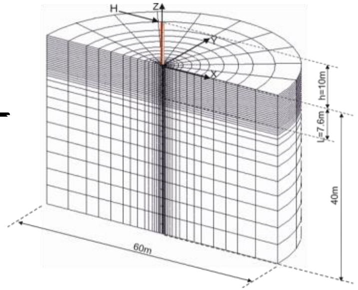
PISA Project Overview – 2014-2018

Advanced Numerical Modelling

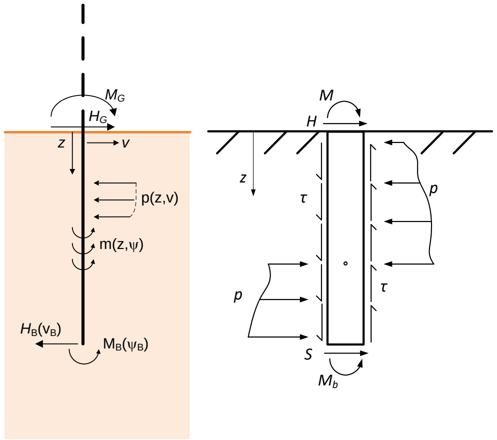


Design

Validate

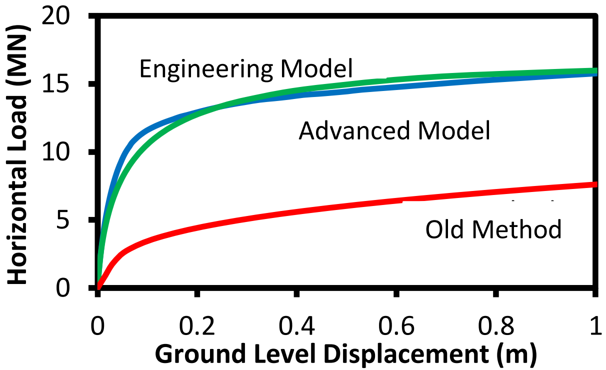
Field Tests

Simplified Engineering Models



Apply to Design

Accurate Response Prediction



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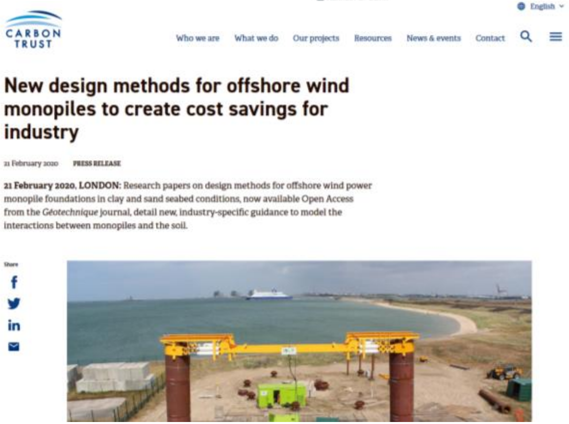
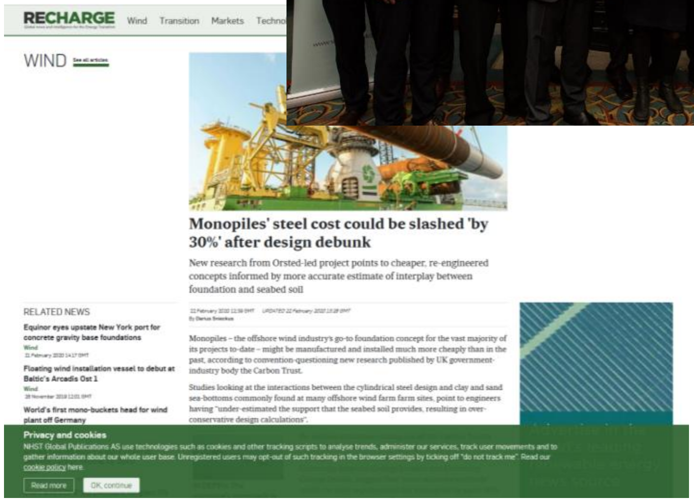
Method applied to Hornsea 1 operating since 2020





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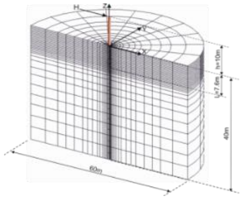
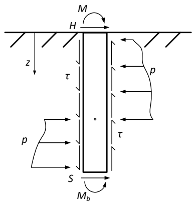
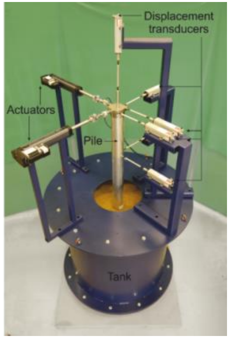
PICASO: Oxford – Ørsted Collaboration 2018-2023

WP1: Modelling

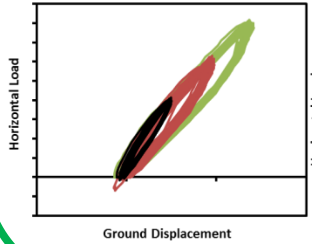


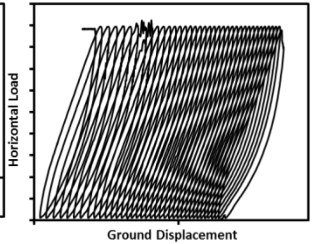


WP2: Calibration Methods

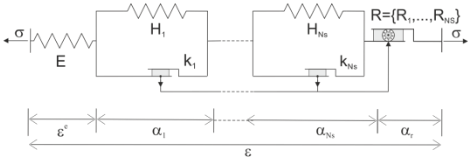


WP4: Field Testing

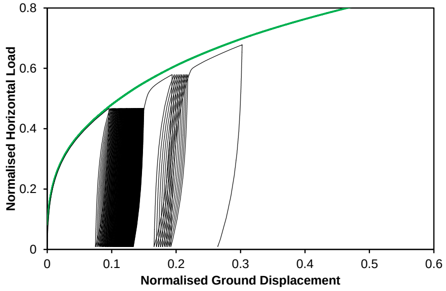




WP3: Theoretical Methods



WP5: Application to Design



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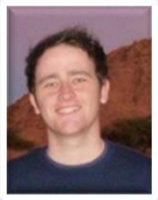
Oxford Centres for Doctoral Training




- EPSRC funded - creating future technical specialists for the sector
- REMS: Renewable Energy Marine Structures (2014 to 2022)
  - Collaboration with Cranfield and Strathclyde Universities
  - Focus on geotechnical and structural engineering
  - 7 Oxford graduated students working in the industry, 6 Oxford students on-course
- WAMESS: Wind and Marine Energy Systems and Structures (2019 – 2027)
  - Collaboration with Strathclyde and Edinburgh Universities
  - Focus on disciplines across the range – electrical, mechanical, structural, geotechnical, fluids
  - 11 Oxford students on-course across three cohorts
- Taught program combined with doctoral research activities
- Significant industry engagement including through a DEng program
  - Ørsted, E.ON / RWE, Fugro, Atkins, HR Wallingford, Siemens







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Concluding Remarks

- Offshore wind energy is a major part of the UK and World Energy mix and will be for the foreseeable future

- New approaches have been developed to more accurately design wind turbine foundations to allow site-wide optimisation

- Cyclic loading from the environment is the most significant challenge to address and is the focus of current efforts across the industry

- Oxford is leading the training of the next generation of technical specialists for the offshore wind and renewable energy sector