

**Australian Oil & Gas Knowledge Forum**  
**Offshore Marine Technology Showcase - Offshore Renewable Energy**

# **The Offshore Renewable Energy Challenge**

March 2019

[www.waves-group.co.uk](http://www.waves-group.co.uk)

- Potential for growth in the blue economy
- Challenges installing power generating facilities from
  - Wave power
  - Tidal power
  - Wind Power
- Challenges installing;
  - Inter Array Cables
  - Export Cables
- Challenges experienced as a Marine Warranty Surveyor

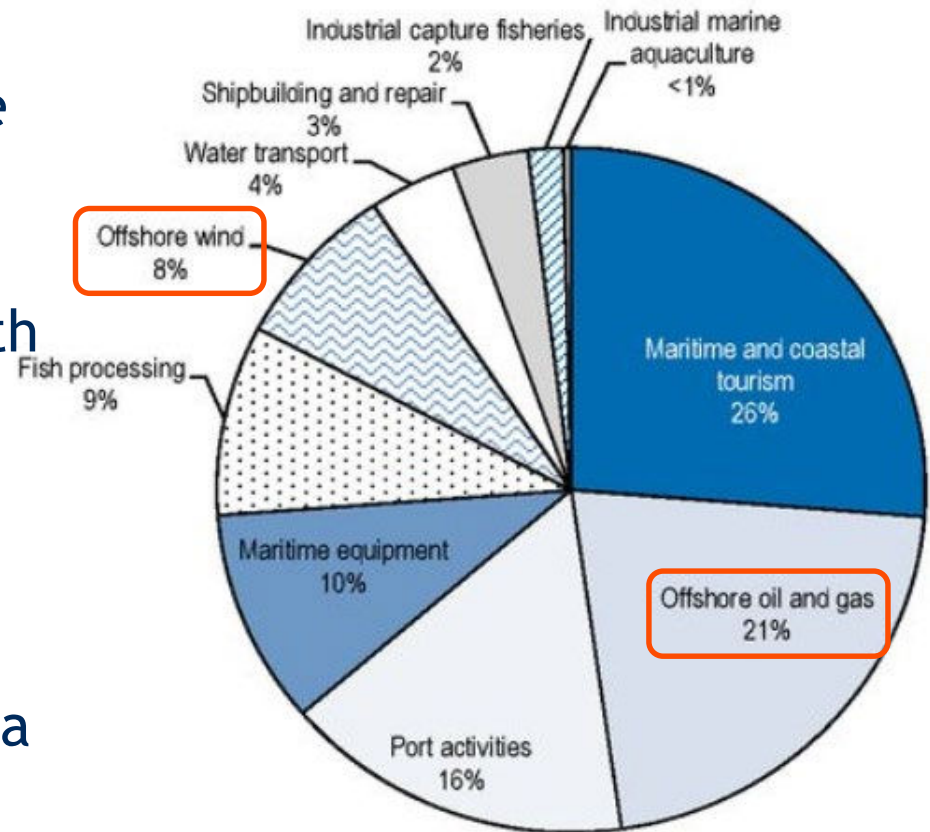


- Consultancy services for shipping and offshore energy industries
- Founded in 2005
- Completely Independent
- Available worldwide with offices in London, Aberdeen & Singapore
- Staffed by: Master Mariners, Marine Engineers, Naval Architects, Marine Civil Engineers and Structural Engineers



# Potential for offshore renewables growth

- Significant growth world wide in renewable energy, Europe, US and the Far East
- OECD\* predicting 24.5% growth in offshore wind (2010-30)
- 8% of the ocean economy will be from wind
- 21% from Oil and Gas
- Largest wind farms are of Giga Watt magnitude.



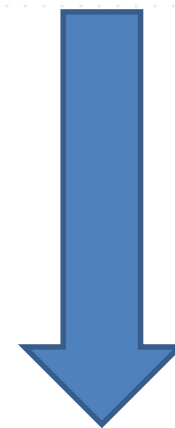
\*OECD (2016), "Ocean industries to 2030", in *The Ocean Economy in 2030*, OECD Publishing, Paris,

<https://doi.org/10.1787/9789264251724-11-en>

# Potential for offshore renewables growth

## Levelised Cost of Energy

- Offshore wind in 2017 was \$0.14/kWh
- Offshore wind in 2020 and beyond, falling to between \$0.06 and \$0.10/kWh



## Compared with -

- Fossil fuel-fired electricity cost in 2017 varied between \$0.05 to \$0.17/kWh



Costs in USD

IRENA (2018), *Renewable Power Generation Costs in 2017*, International Renewable Energy Agency, Abu Dhabi.

[https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA\\_2017\\_Power\\_Costs\\_2018\\_summary.pdf](https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_2017_Power_Costs_2018_summary.pdf)

# Potential for offshore renewables growth

Australia is well placed to develop its offshore renewable energy industry

- Cost savings threshold of established market is 3GW~4GW. (Bloomberg)
- 2GW Star of the South offshore windfarm planned.
- 10 million Square kilometres of EEZ



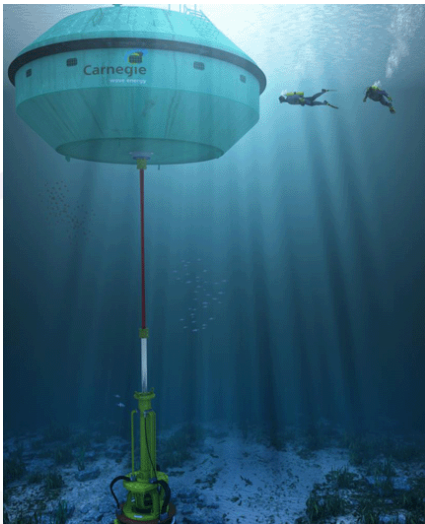
Australian Exclusive Economic Zone (EEZ)



# The challenges of wave energy project installation



Carnegie CETO wave energy system



<https://www.carnegiece.com/wave/what-is-ceto/>



Pelamis Wave Energy Converter (Now decommissioned)

<http://www.emec.org.uk/about-us/wave-clients/e-on/>



# The challenges of tidal energy project installation



Tidal turbine loadout



Flow past stationary turbine during recovery



Tidal turbine installation



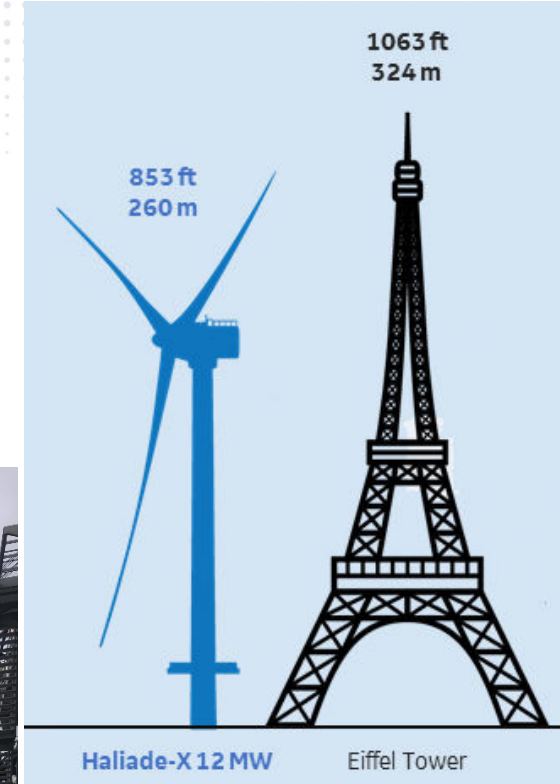
# The challenges of wind energy project installation



WTG jacket foundation  
(50m water depth)

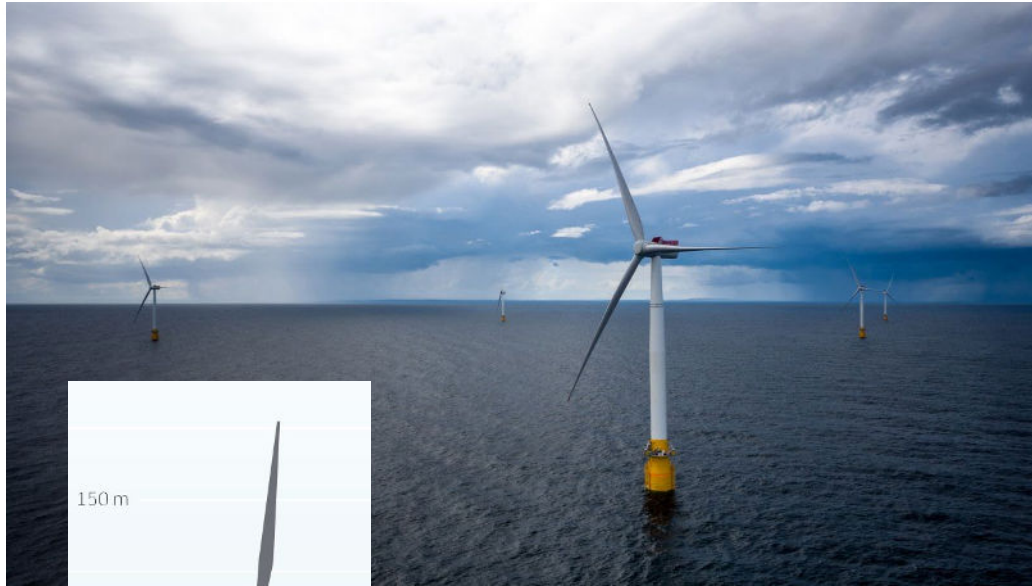


7MW WTG  
installation



12 MW WTG  
(planned ~2021)

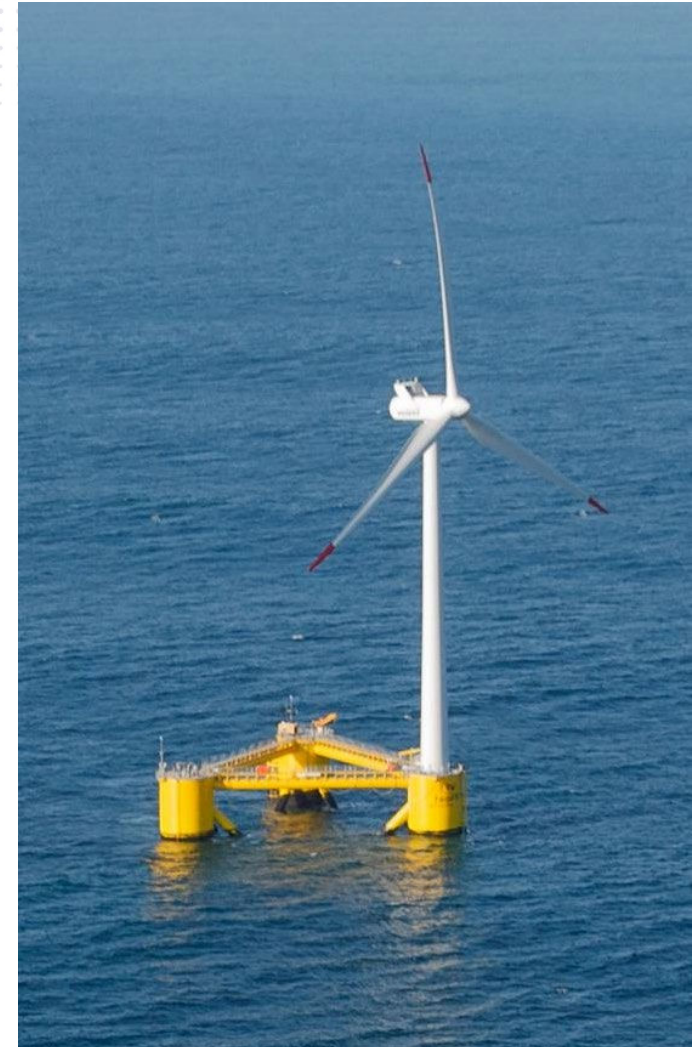
# The challenges of wind energy project installation



Spar Buoy:  
Hywind Scotland Pilot Park (5 x 6MW)



3 Column Platform:  
Windfloat 2MW prototype

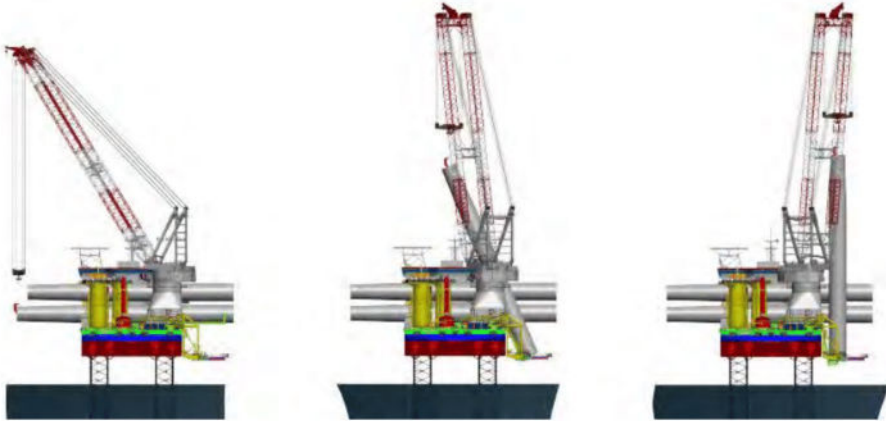


<https://www.equinor.com/en/what-we-do/hywind-where-the-wind-takes-us.html>

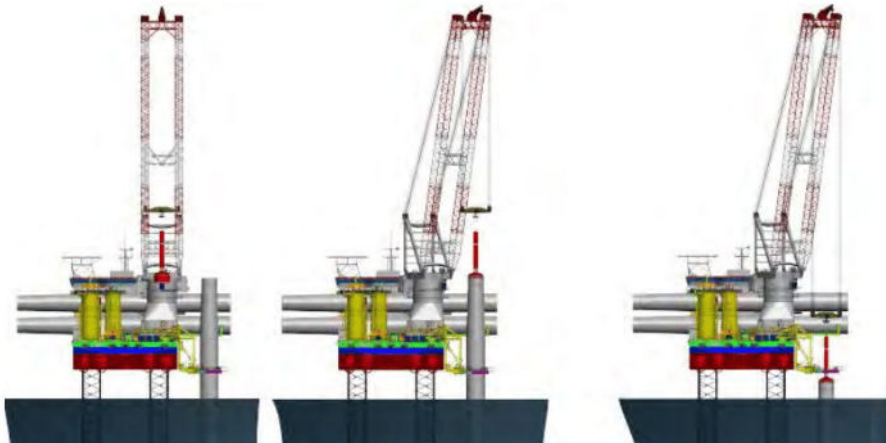
<http://www.principlepowerinc.com/en/windfloat>



# The challenges of wind energy project installation

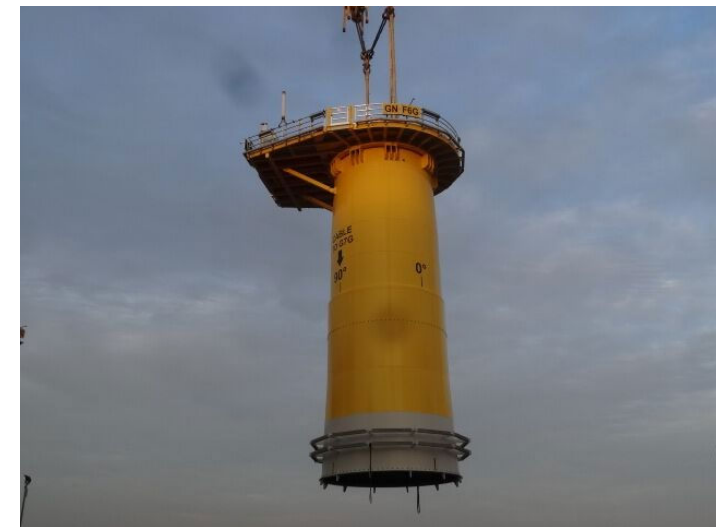


Monopile (MP) upending



Monopile (MP) driving

Lowering  
hammer over MP



Transition Piece (TP) installation on MP

# The challenges of wind energy project installation



Jacket (including transition piece)

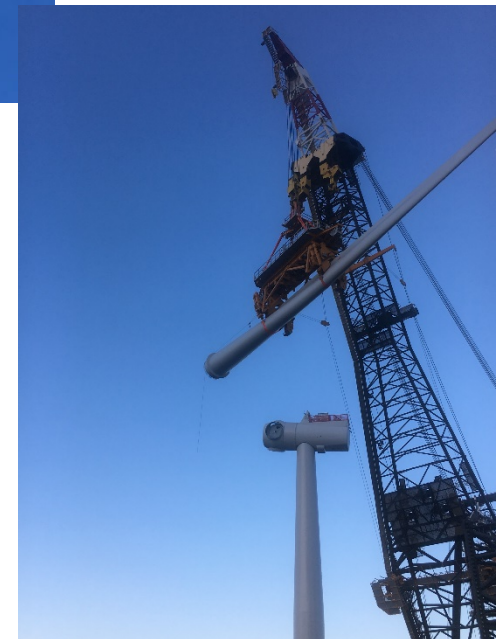


Nacelle lowered onto tower



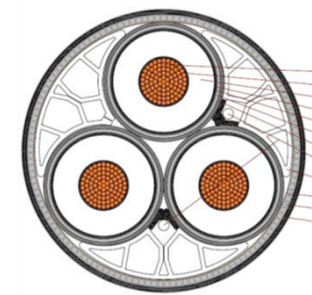
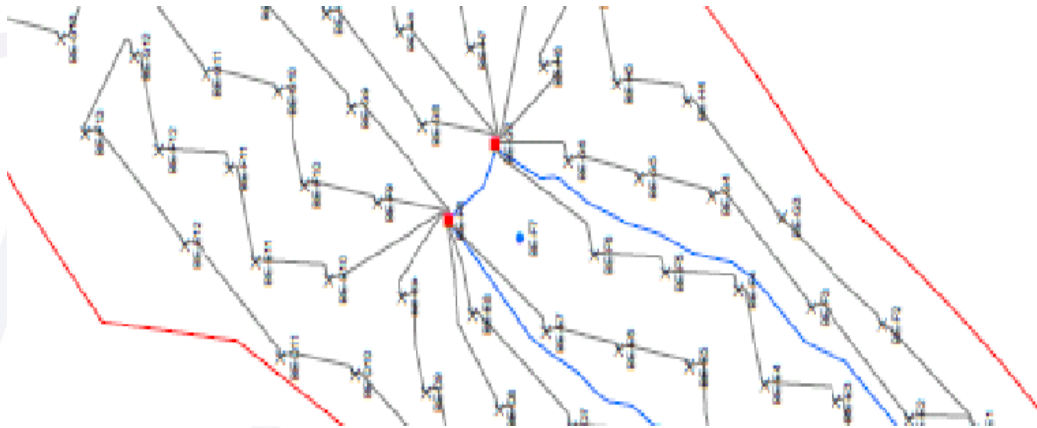
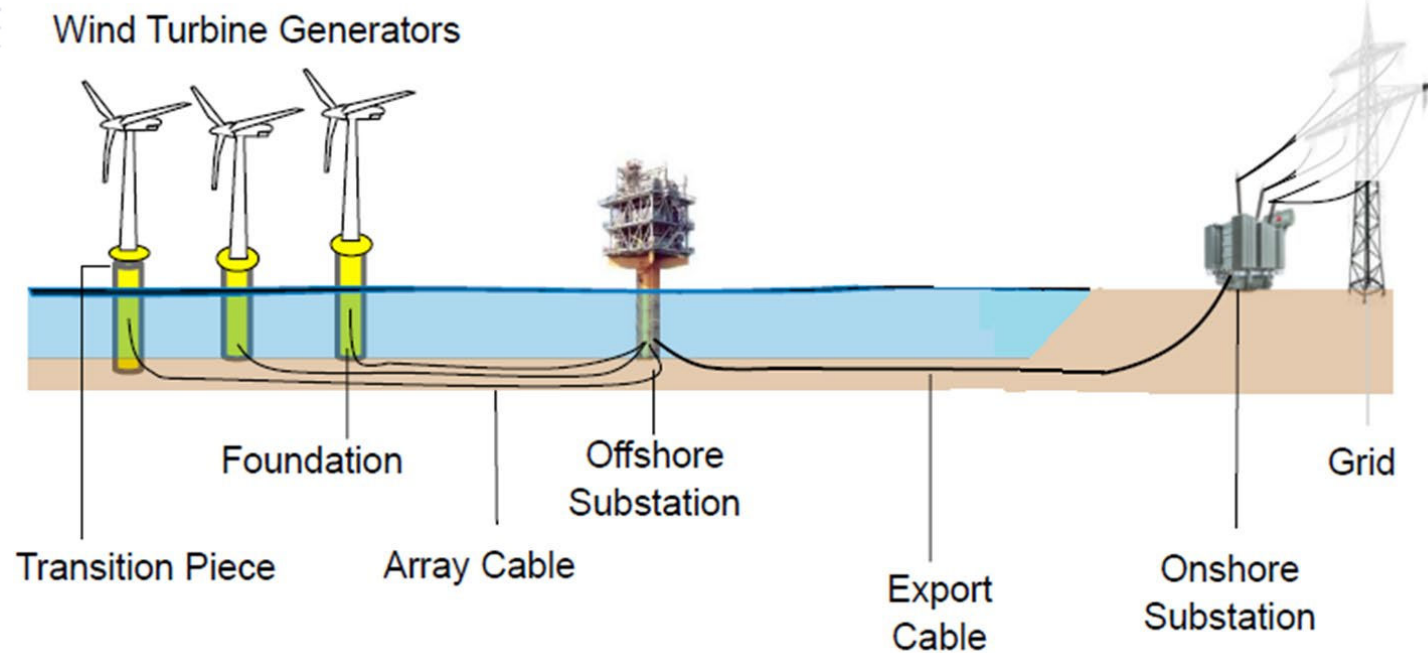
WTG tower lifted onto TP

Blades connected to tower





# The challenges of installing array and export cables



3 Core HVAC

# The challenges of installing array and export cables

## Cables:

- ~20% OWF construction cost
- ~80% insurance claim cost
- Installation claims falling
- Operating claims rising



Carousel of  
export cable  
lay vessel



Export cable  
joint  
overboarding





# The challenges of installing array and export cables

- Cables are relatively delicate
  - Cannot tolerate compression
  - Limited tension
  - Limited bend radius
  - Limited side wall pressure
- Array cables installed in a day
- Export cables up to 14 days
- Cable joints require at least 5 working days of good weather
- Cutting cable \$5-10m claim
- Burial - tool dependant on soil conditions



## Procedures for multiple:

- Loadouts
- Sea transportations
- Installation
- Cable laying
- Cable burial
- Weather assessments
- DP run off

Non-Adherence can result in a breach of warranty





# MWS Experiences

## Vessel Logistics

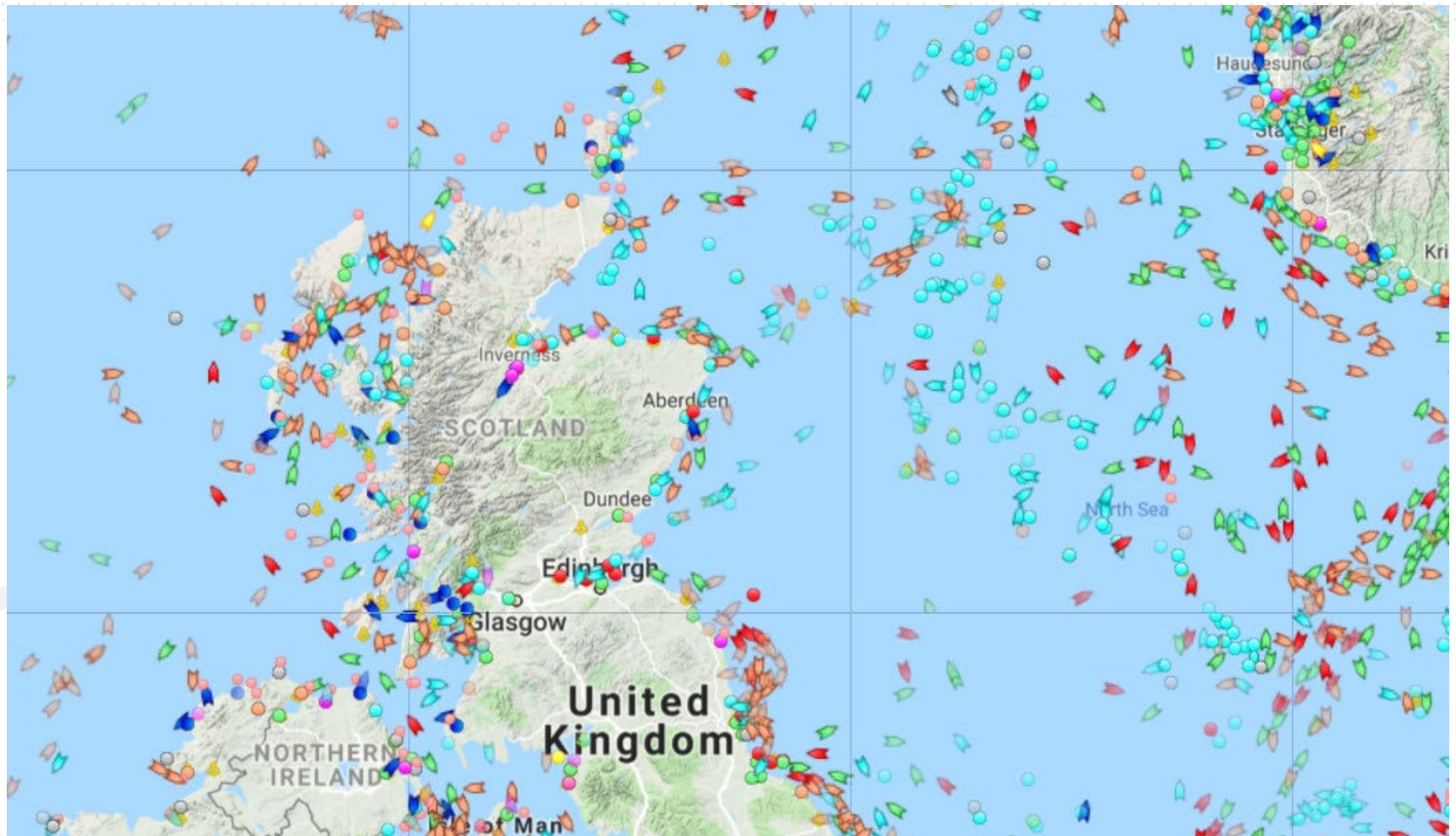
Items to install for typical 50 wind turbine offshore windfarm:

Foundation Jacket	50 pieces	1000 t / piece
Piles	200 pieces	150 t / piece
Towers & Nacelles	100 pieces	300 t / piece
Blades	150 pieces	80 m length
Bolts and other small items	1000s pieces	10 kg / piece
HV Cable	-	100s km
Transformer stations and jackets	4 pieces	1500 t / piece

Vessels operating on the project (SIMOPS):

1 x Heavy Lift Vessel	1 x Survey Vessel
1 x Jack-Up Vessel	1 x Trenching / Burial Vessel
1 x Offshore Construction Vessel	6 x Pontoon Barges
1 x Cable Lay Vessel	8 x Offshore Tugs

# MWS Experience Vessel Logistics





# MWS Experiences Vessel Logistics



**QUESTIONS?**

**Thank You.**

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