

Floating Wind Solutions

Floating wind turbines tow-to-shore
for large correctives in real life

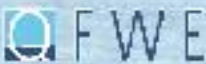
Seth Price – VP Technology & Innovation



Globalizing
floating wind



Organized by



Quest Offshore



The Marriott Marquis, Houston Jan. 30 - Feb. 1 2023



Today we will present:

1. Principle Power
2. Operating WindFloat units
3. WindFloat large corrective plan
4. Kincardine large corrective operation
5. Schedule optimization
6. Lessons Learned
7. Improved solutions
8. Conclusions



Principle Power: Globalizing floating wind



Founded in 2007, Principle Power has grown to be a global leader in the floating offshore wind industry



Headquarters in California with offices in Portugal, France, UK, Japan, Texas and ~120 employees from over 20 different nationalities



Backed by global energy and utility leaders and involved in partnerships with influential industry players



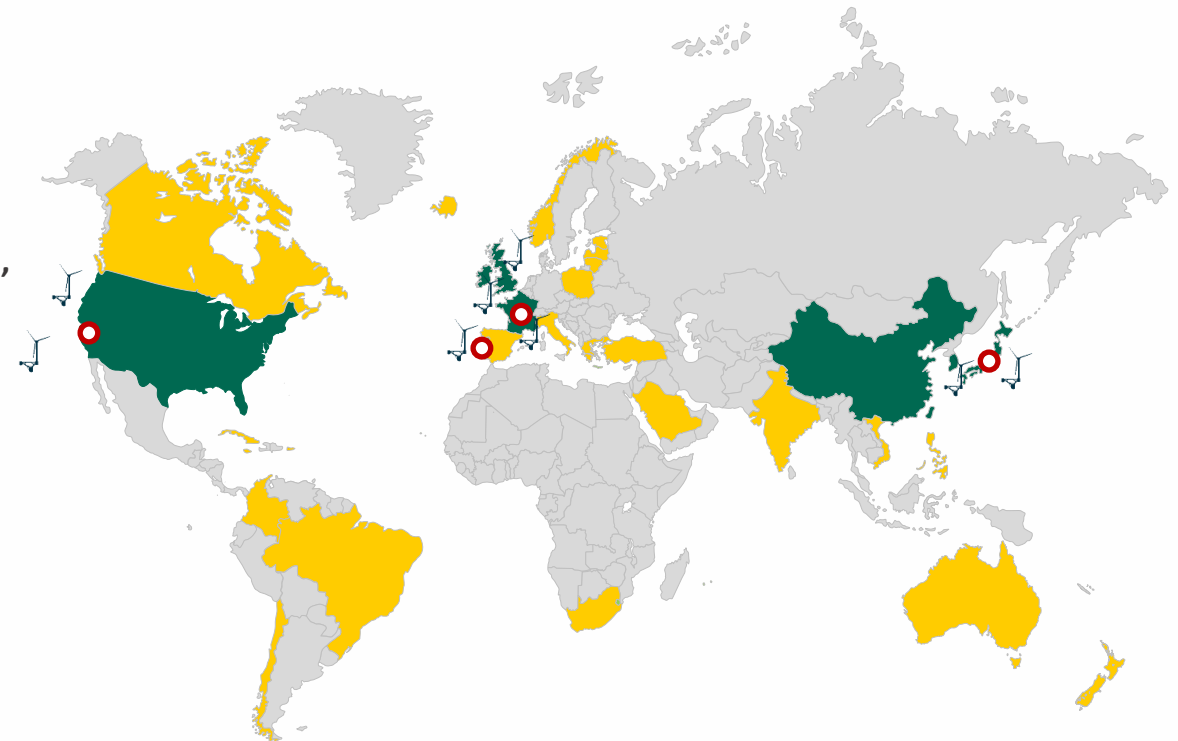
Globally patented and proven floating platform technology with 75 MW in operations and 126 MW under deployment



Important global project pipeline secured & serving clients in all key floating offshore wind markets



principlepower.com



● Existing developments and/or strong market potential

○ Office location

● Promising market




🌪️ Project pipeline



WindFloat offers excellent proven platforms availability






WindFloat Atlantic, Portugal

-  3 WindFloat units
-  V164 8.3 MW
-  4th year of operation



Kincardine, Scotland

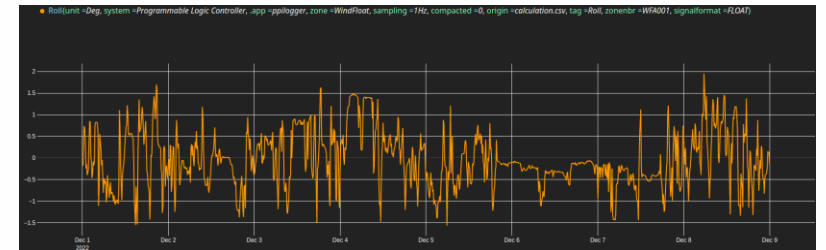
-  5 WindFloat units
-  V164 9.5 MW
-  2nd year of operation



And recorded limited floater motions



KIN04
Exposed to 8m Hs during a storm in Sept. 2022



Roll angle average
10min between Dec. 1st and Dec. 9th, 2022



WindFloat enables Tow-to-Shore for large component exchanges



Plug-n-play connection system

Principle Power patented plug-n-play solution allows (dis)connection operations to be performed in 1 day

Principle Power patented floating I-Tube ensures uninterrupted production through the array during while affected unit in transit and repair



Heavy O&M in the harbor

WindFloat's shallow draft (adjustable ballast) allows up-tower repairs to be performed quayside in most harbors

Standard onshore cranes have suitable reach/capacity due to location of WTG on outer column



Easy installation via towing

Low system pretension means simple offshore tugs can be used for towing operations, even for next-gen WTGs

No vessel availability risk; short mobilization times

Lower weather risk and interface risk with offshore contractor.



WFA unit at quayside, Spain

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Kincardine successful large corrective operation

- **WFA platform design duplicated for fast track KOWL project**
 - Not many compatible marshaling port options in the North Sea
 - Supply chain in place at the Port of Rotterdam
 - Significant towing length
 - Requirement for installation of lifting bags to reduce the platform draft at quay side
- **Kincardine export cable arrangement in a loop does not require continuity of cable when 1 unit is removed**
 - WindFloat platforms are not fitted with disconnectable floating i-tubes



Kincardine large corrective operation

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Kincardine successful large corrective operation

▪ Key success factors

- Typical sequence as planned;
- Port selection process;
- Collaborative project organization:



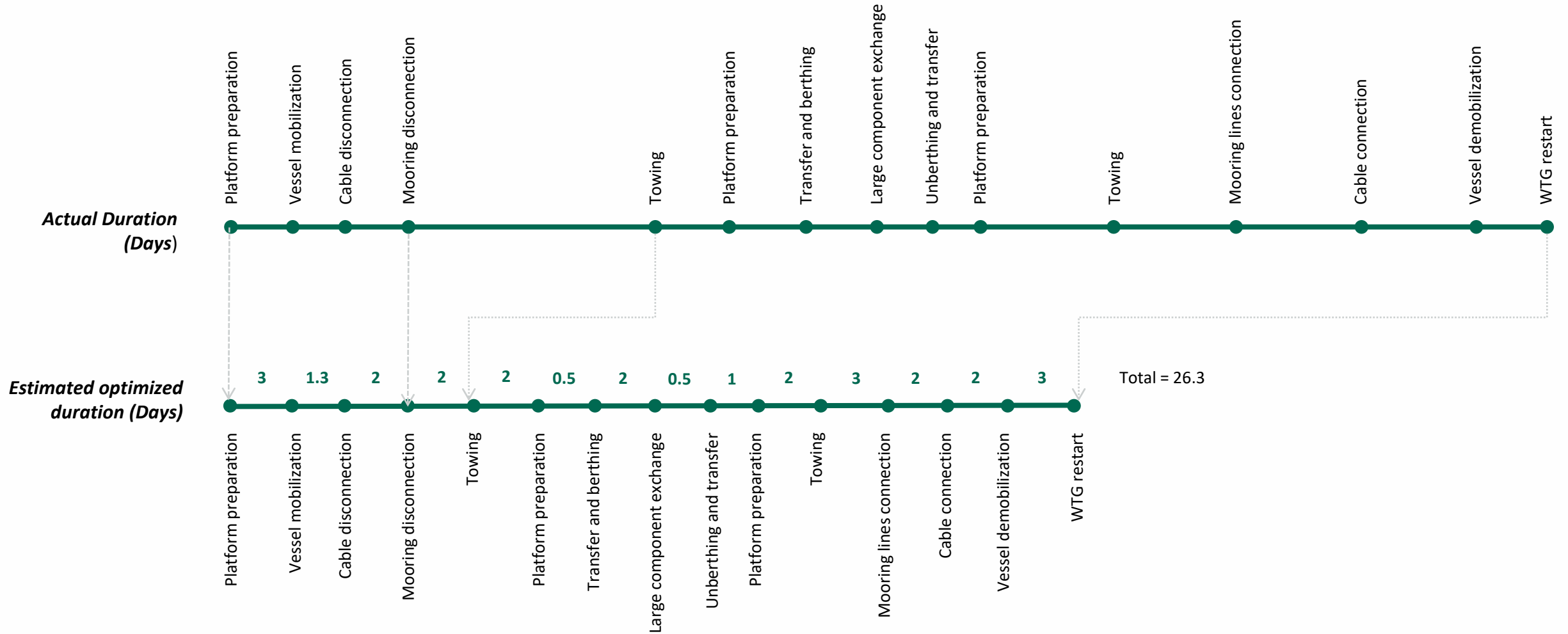
Kincardine large corrective operation

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Optimized schedule allows for parallel operations





Lessons learned for commercial scale development

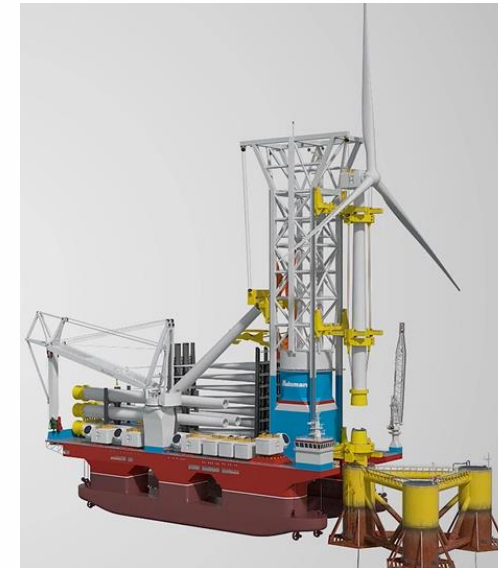
- **Supply chain will need to prepare for large corrective operations:**
 - Need for ports near project sites with adequate infrastructure (Water depth, quay length, lifting capacities,..);
 - Frame agreement with ports to ensure compatibility of large corrective operations;
 - Platforms designed to consider local infrastructure constraints;
 - Spare parts strategy in place to ensure available of components.





Continuous pursue of improved solutions

- **Technology maturity has instigated innovation towards optimized operations:**
 - Principle Power is involved with several technology providers to develop offshore lifting solutions while still improving the disconnectable WindFloat solution;
 - Multiple solutions are being designed to be compatible with the WindFloat platform;
 - The average readiness level of novel technologies is relatively low and only some companies have gone through prototype testing.



Courtesy of Huisman Equipment





Conclusion

- **Demonstrated** the feasibility of disconnection and reconnection of the WindFloat platforms for large correctives at quay side;
- **Compatibility** with commercial objectives;
- Large corrective operations must be included in the commercial development of floating wind;
- Principle Power will continuously improve this field through compatible alternative solutions.





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