PRINCIPLE POWER

2019 FRENCH AMERICAN INNOVATION DAY BOSTON

WindFloat

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18th March, 2019

France in the United States
Consulate of France in Boston

IUML
INSTITUT UNIVERSITAIRE MER & LITTORAL
FR CNRS 3473

Northeastern University

UNIVERSITÉ DE NANTES

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
EMBASSY OF FRANCE IN THE UNITED STATES
OFFICE FOR SCIENCE & TECHNOLOGY

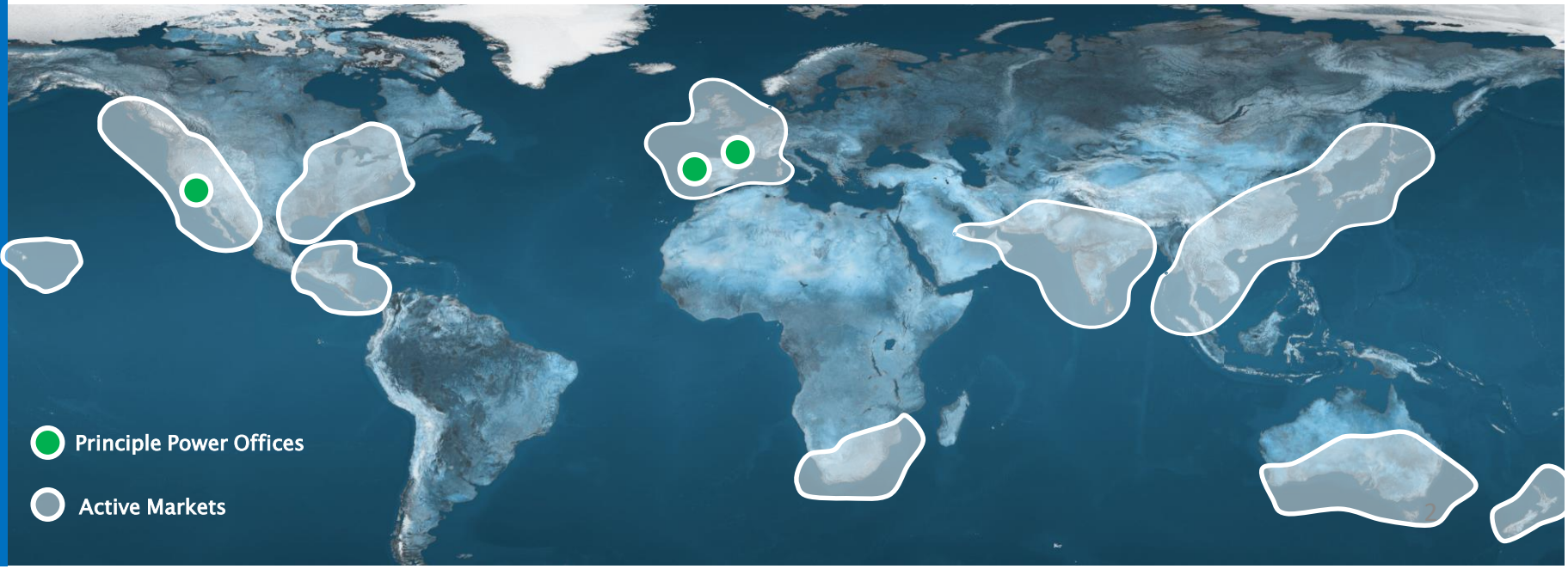
Principle Power

Headquarters in Emeryville, California with offices in Portugal and France

Backed by global energy and utility leaders

Globally patented, proven floating platform technology: the WindFloat

Global project development based on low cost of energy and low technology risk



Presentation Summary

Going Offshore

WindFloat Technology

Technical Viability

Going Further

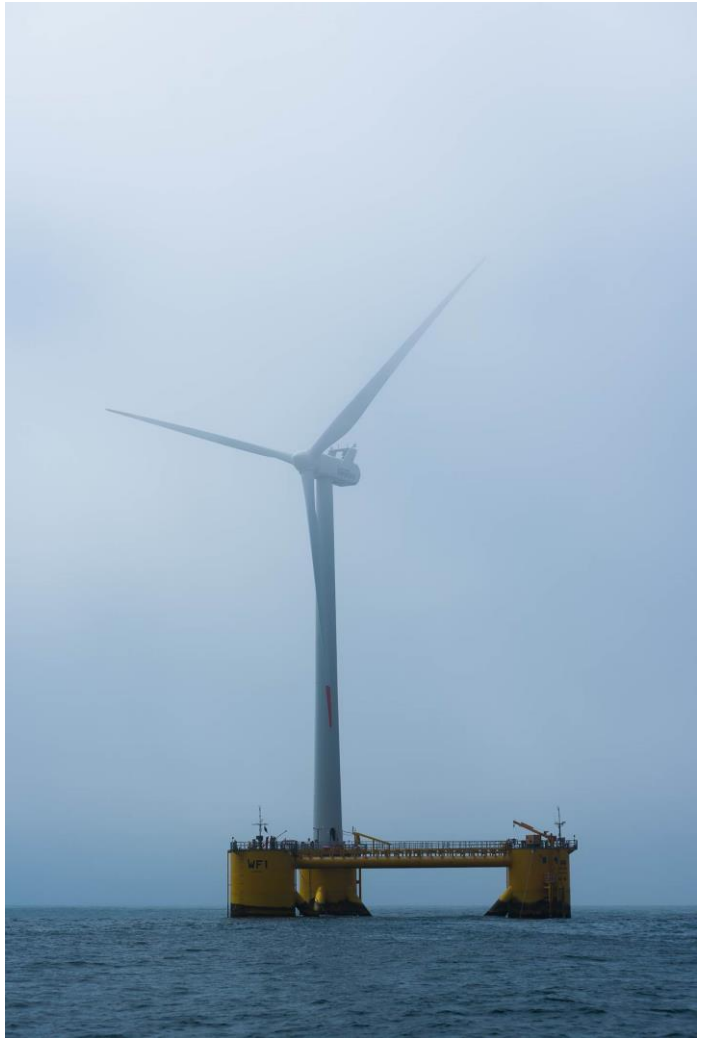
Precommercial Projects

Lowering risks and enabling Financing

Going Global

Worldwide commercial projects

Industrialization & supply chain




Going Offshore,
Proving the technology

Our Focus: industrializing the technology to create competitive commercial projects.

Prototype

1 unit
2-4MW

2008-2014
6 years
WF1 2 MW

Pre-Commercial

4-6 units
25-50MW

2014-2020
6 years
WFA 25 MW
KOWL 50 MW
EFGL 25 MW
Total: 100 MW

Commercial

10-50 units
100-500MW

Ready by 2020

Industrialized

50-100 units
1GW+

>2025

The WindFloat

Globally Patented, Proven Floating Technology with 5y operation

Leading in Cost and Performance; LCOE competitive with currently commercial technologies

Reduction of Cost and Risk for the Industry

The WindFloat design is predicated on well-established and proven offshore oil & gas semisubmersible platform technologies

The Semisubmersible technology is viable in all types of water depths above >40m

WindFloat Technical Overview.

A. Hull Trim System (Active ballast)

Displaces some water between columns to compensate for changes in mean wind velocity and direction

B. Heave Plates (Dynamic Stability)

Move platform natural response above the wave excitation; Viscous damping reduces wave induced motions

C Turbine Agnostic

Any conventional commercial Turbines

D. Water Ballast (Operational draft)

Located at the bottom of each column and used to achieve operating draft

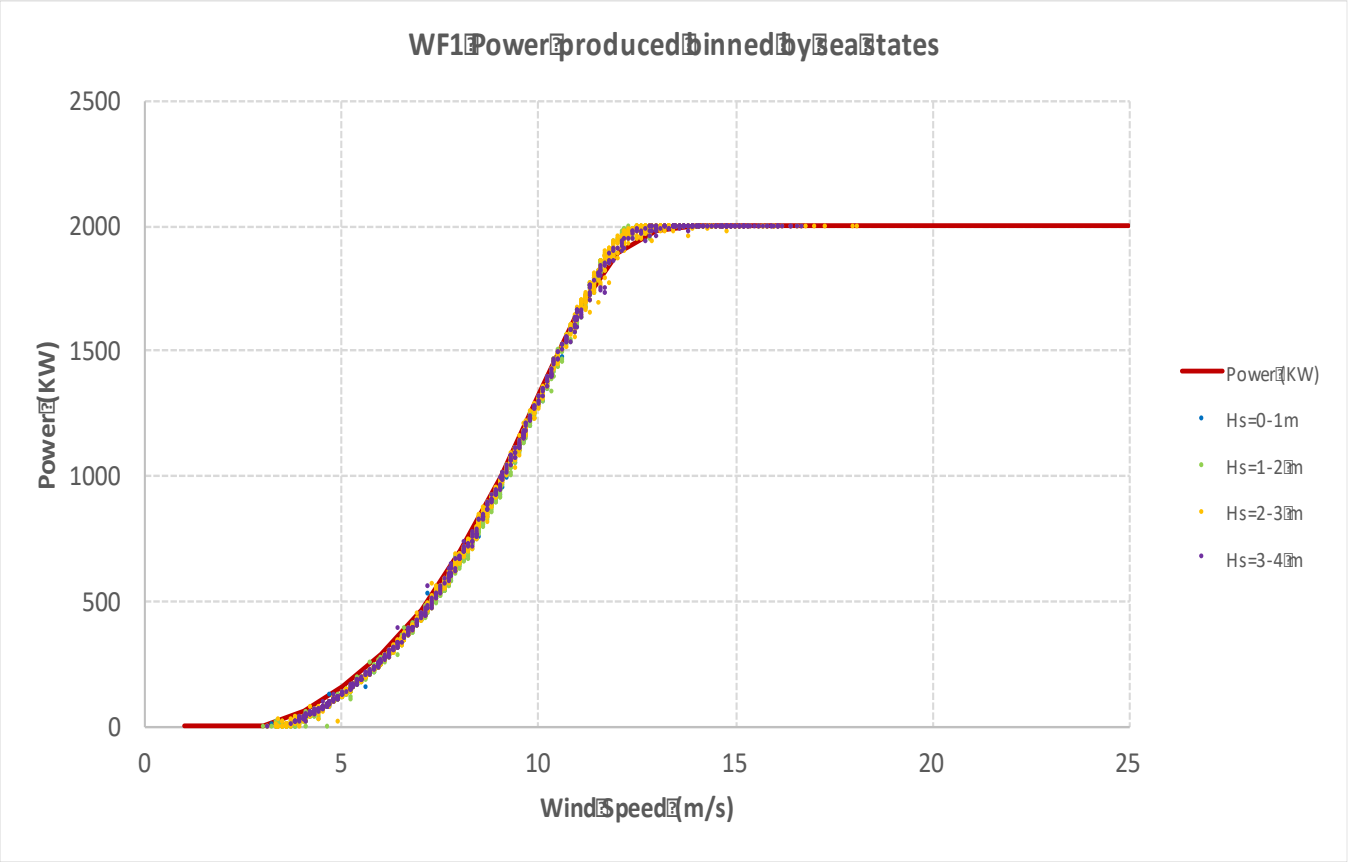
2011 WindFloat 1 Prototype objectives

- ✓Demonstrate ability to: fabricate, commission at quayside and install fully-assembled WindFloat
- ✓Produce power up to the one-year storm and survive large winter storms with now damage
- ✓Withstand wave- and wind-induced fatigue
- ✓Perform O&M activities on the platform
- ✓Operate the Active Ballast System and other systems and equipment
- ✓Predict the important responses of the system with numerical tools
- ✓Return turbine to shore for decommissioning at quayside with minimal budget and impact to the environment

WindFloat I most significant achievements

No Impact on Turbine Performance

- ✓ Full Scale 2 MW VESTAS Turbine
- ✓ No power performance losses
- ✓ The WF platform does not induce a negative effect in the performance of the turbine
- ✓ Operate up to 6.6m significant wave height (Exceeded 1% of the Time → High Availability)



WindFloat I most significant achievements

Extreme Conditions Tested

- ✓ Extreme Weather Conditions ≈ 17 m waves, ≈ 60 kn wind
  - No structural damages
  - No WTG component damage
  - Validated Numerical models
- ✓ MHVestas confidence in WindFloat gained through WFA drives decision to supply turbines to WFA project (fully bankable contracts)

WindFloat I most significant achievements

Extreme Conditions Tested

WindFloat I most significant achievements

Decommisiong

- ✓ Very important step to complete demonstration of WF1 major features/benefits:
  - Ability to unhook moorings safely
  - Ability to tow back easily to port
  - Ability to dismount turbine at quay side
  - Utilization of low cost vessels and equipment
- ✓ WF1 Decommissioning completed within July. Unhooking 07/08 and Turbine removal on 07/25
  - On Schedule
  - On Budget
  - No Safety Incidents

WindFloat I most significant achievements

Life Extension (WF1 → KIN1)

- ✓ Kinkardine 50 MW, Phase 1:
  - Sold to new client, full inspection, repairs and updated, Transported to UK, Installed and Operating in about one year.

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Going Further,
Financing and risk reduction

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4-6 units
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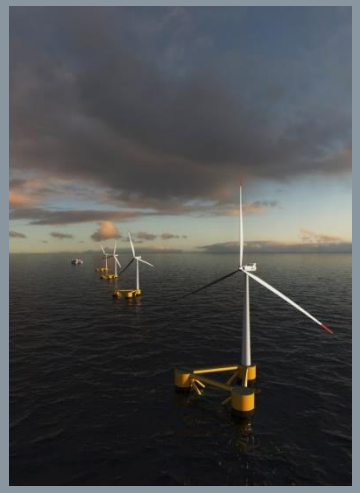

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WFA 25 MW
KOWL 50 MW
EFGL 24 MW
Total: 99 MW

Commercial

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100-500MW

Ready by 2020

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The WindFloat Solution

A 3rd Generation Technology

- Life Extension (to 25 years)
- Larger Turbines
- Structural Optimization
- Equipment Optimization
- Quick Connect Cable
- Quick Connect Mooring

→ Smaller Floater in Proportion:
Typically 200-300t/MW depending on local site conditions.

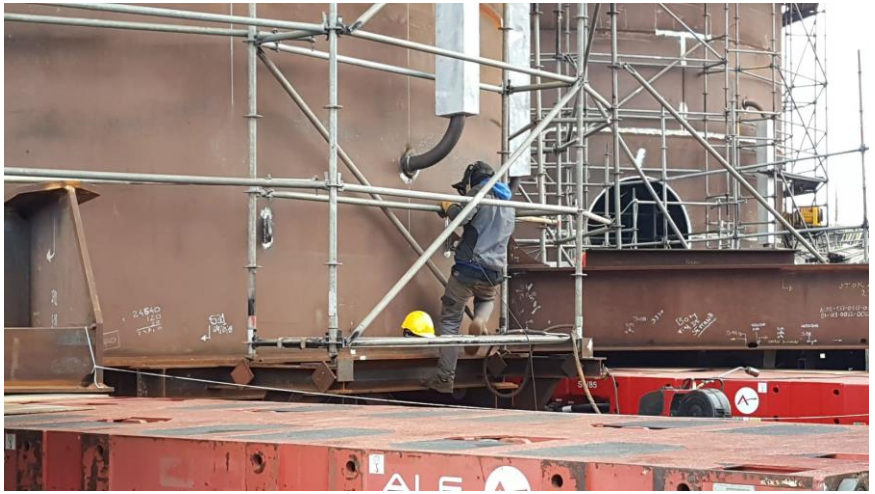
- **Capacity:** X3-4
- **Production:** X4-5
- **Unit Cost:** x1.75

Class approved: ABS, BUREAU VERITAS, ClassNK

Demo-scale projects structured to: 1) Prove Bankability and 2) Advance LCOE => a Gateway to large commercial scale

WindFloat Atlantic (WFA)
25 MW, Portugal, Operational 2019

- 3x 8.3 MW MHI Vestas
- 20 km out; 100 m deep
- Local Shipyard Construction
- Certified by ABS
- Feed-In Tariff
- Equity Financing complete w/ strong international sponsors
- First Non-Recourse Project Finance of a Floating Wind Farm



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ENGIE

MHI VESTAS OFFSHORE WIND

REPSOL

European Commission

GOVERNO DE PORTUGAL

Demo-scale projects structured to: 1) Prove Bankability and 2) Advance LCOE => a Gateway to large commercial scale

WindFloat Kincardine (Scotland)

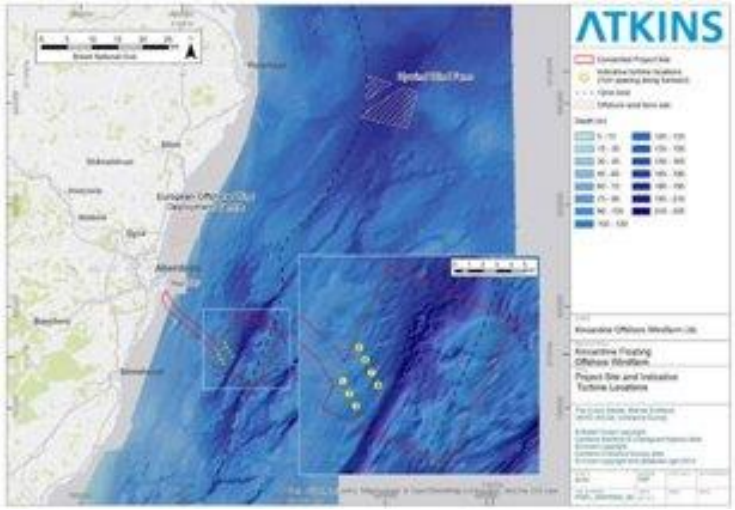
- Location: 15 km east Aberdeen
- Waterdepth: 60m

Phase 1: 2 MW, Operational 2018

- WF1 Life Extension
- Prototype Sold to Cobra
- Inspect, retrofit and moved to Scotland – Spring and Summer '18)
- Install and power production September '18
- Unlock Scottish ROC Tarif

Phase 2: 48 MW, Operational 2020

- Front-End Engineering: 2018
- Detailed Engineering and Procurement – 2019
- Fabrication yard Selection: 2019
- Construction and Installation – 2020



cobra

scottish renewables

KOWL

MHI VESTAS OFFSHORE WIND

Our Strategy: Parallel Tracks to Execute Pre-Commercial Projects and Develop Commercial Projects.

Les Eoliennes Flotantes du Golfe du Lion (EFGL)

24 MW, France, Operational 2020/21

- 4x 6 MW GE
- 18 km out; 70–100 m deep
- Local Shipyard Construction
- Certified by BV
- Feed-In Tariff (through competitive process)
- Very strong consortium with major energy companies and industrials
- Major innovations to advance technology to the next level of competitiveness

Commercial 2019-2025

Redwood Coast (100-150 MW), California

Press Release

Eureka, California, April 2, 2018

The Redwood Coast Energy Authority selects a consortium to develop a floating offshore wind farm off the coast of Humboldt County, California

ENGIE

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SENVION wind energy solutions

GROUPE 2018 1816 - 2016 Caisse des Dépôts

European Commission

EIFFAGE

MINISTÈRE DE L'ENVIRONNEMENT, DE L'ÉNERGIE ET DE LA MER

REDWOOD COAST ENERGY AUTHORITY

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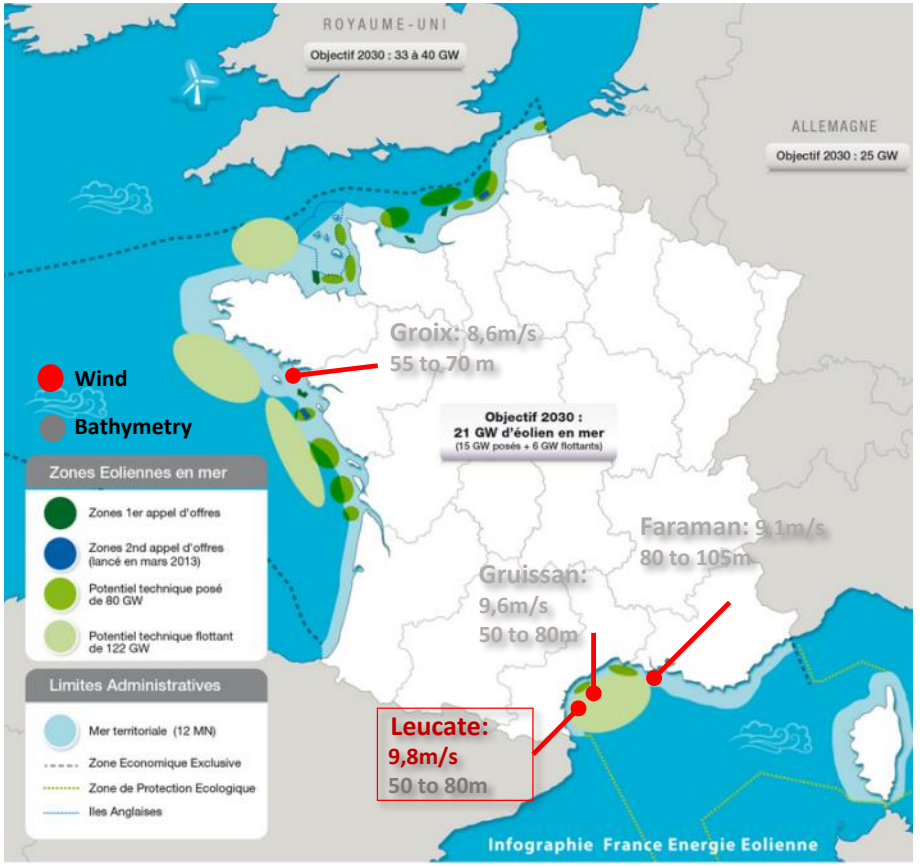
AkerSolutions

EFGL Project: Last development stage of floating technology

- Awarded after a call for project from French Government (ADEME), granting support by both investment aid and feed-in tariff
- **EIFFAGE** provides **strong internal know-how** (offshore O&G, leading supplier of foundation for bottom/fixed offshore wind), and **availability of its yard of Fos/Mer**
- **Several key innovations slated for demonstration at EFGL project:**
  - Industrialization and serial fabrication, early involvement of manufacturer along designer
  - Structural optimization, lower weight ratio and lower draft (easier harbor access),
  - Alternative steels and materials,
  - Hybrid fabrication strategy (balancing local content, local jobs and cost),
  - O&M improvements

Les Eoliennes Flotantes du Golfe du Lion (EFGL)

One of four French pilot projects



Going Global

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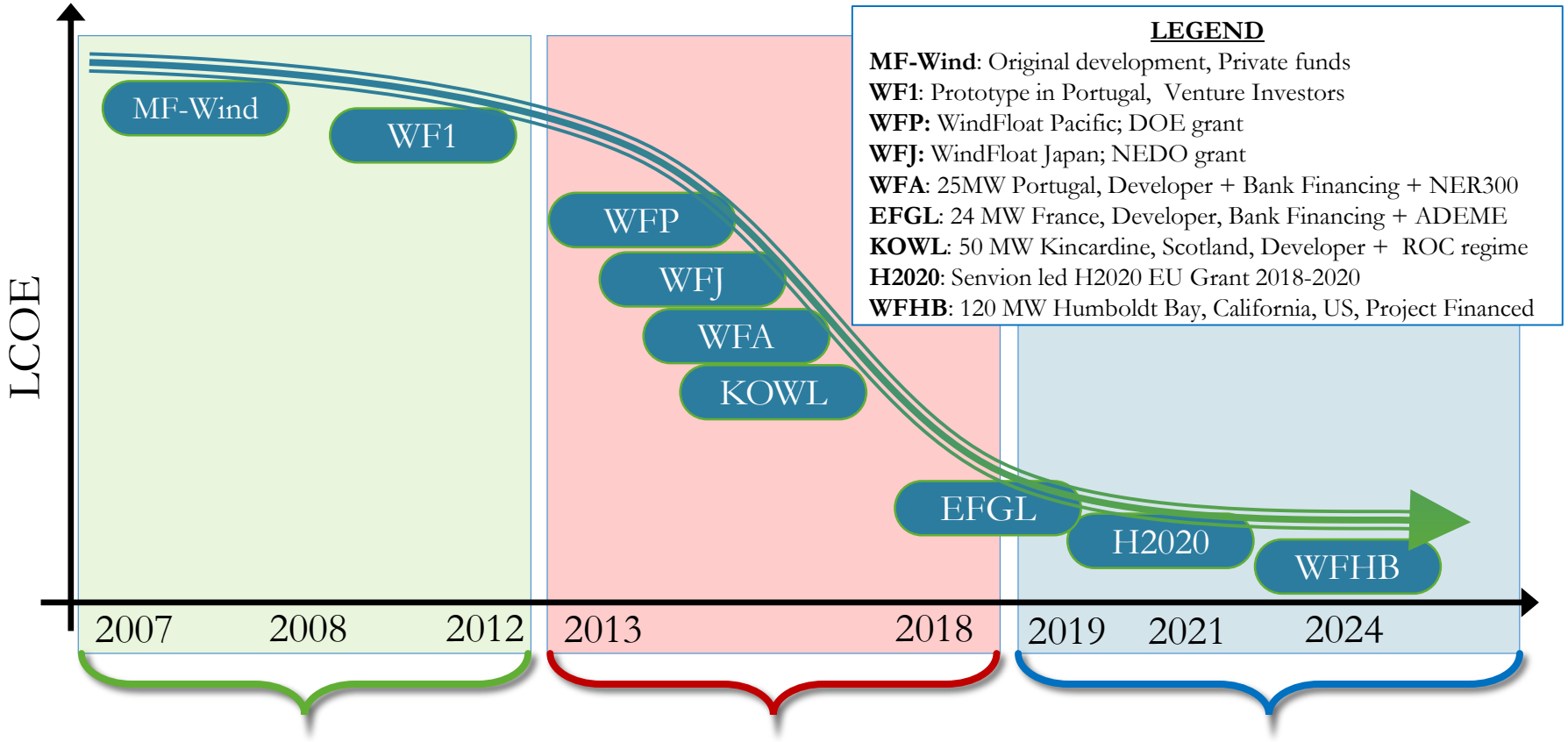
LCOE reduction has been the focus of every project



WindFloat V1.

- **Prototype**
- Turbine size .25-2 MW
- V1.0 3x250KW
- V1.1 1 MW
- V1.2 WF1 (2 MW)

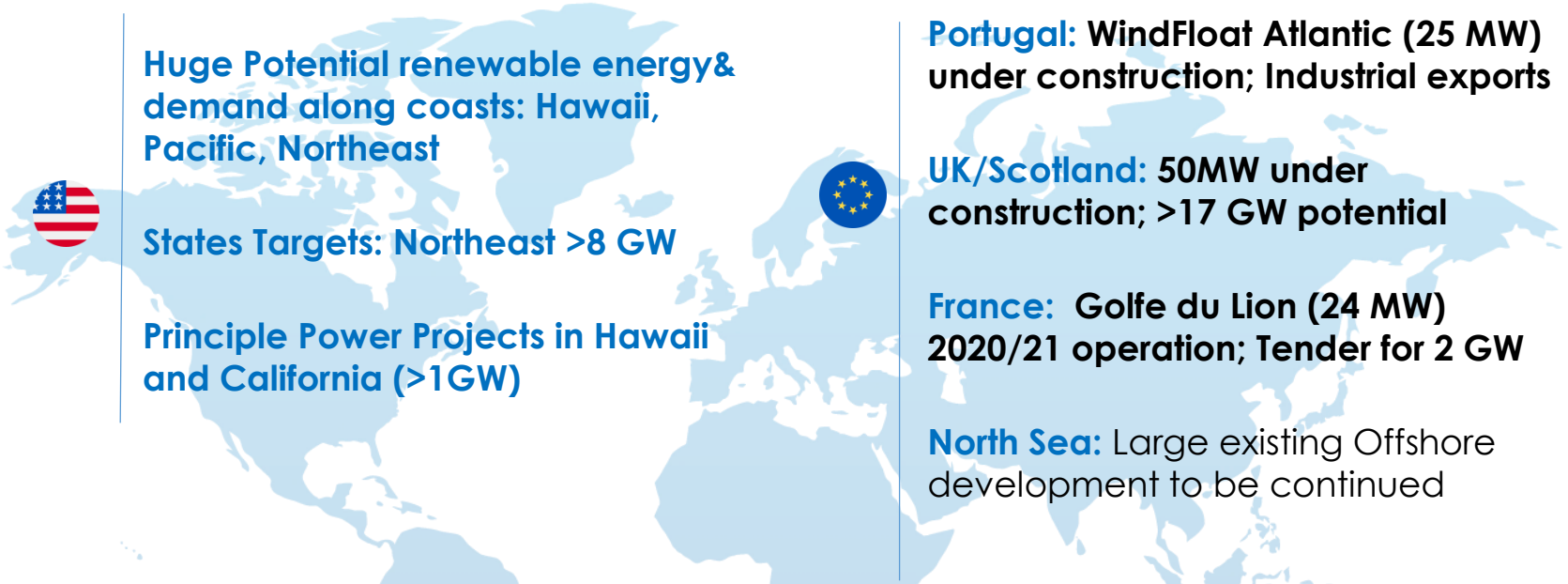
WindFloat V2.

- **Pre-commercial**
- Turbine size 5-8 MW
- V2.0 WFP
- V2.1 WFJ
- V2.2 WFA

WindFloat V3.

- **Commercial**
- Turbine size 6-15 MW
- V3.0 EFGL
- V3.1 H20 10+ MW
- V3.2 RCEA CA, US
- V3.3 500 MW Commercial

100 MW under construction / late stage and large scale project development in several markets.



Huge Potential renewable energy& demand along coasts: Hawaii, Pacific, Northeast

States Targets: Northeast >8 GW

Principle Power Projects in Hawaii and California (>1GW)

Portugal: WindFloat Atlantic (25 MW) under construction; Industrial exports

UK/Scotland: 50MW under construction; >17 GW potential

France: Golfe du Lion (24 MW) 2020/21 operation; Tender for 2 GW

North Sea: Large existing Offshore development to be continued

Asia

Japan: 8 GW by 2030; 18 GW by 2050; >100 MW Project in late stage

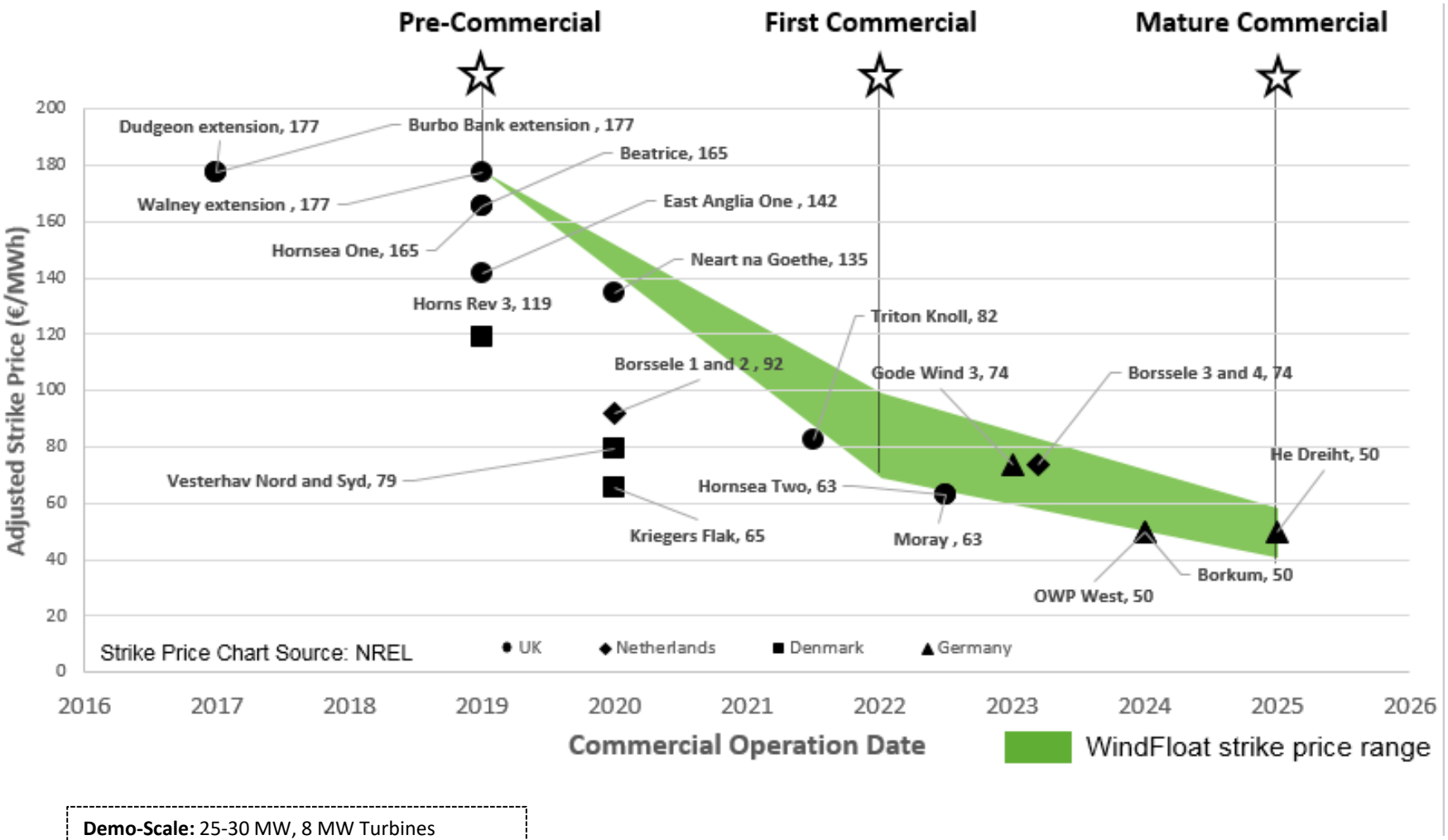
Korea: Large Pipeline of Projects; Attractive Tariff Scheme

Taiwan: Target of 4GW by 2030; deep waters; Attractive Tariff

China: Short Term 30 GW target; Floating to address difficult seabed

India: Fast moving offshore wind; Best wind w/ deep waters

LCOE path competitive with bottom-fixed industry references



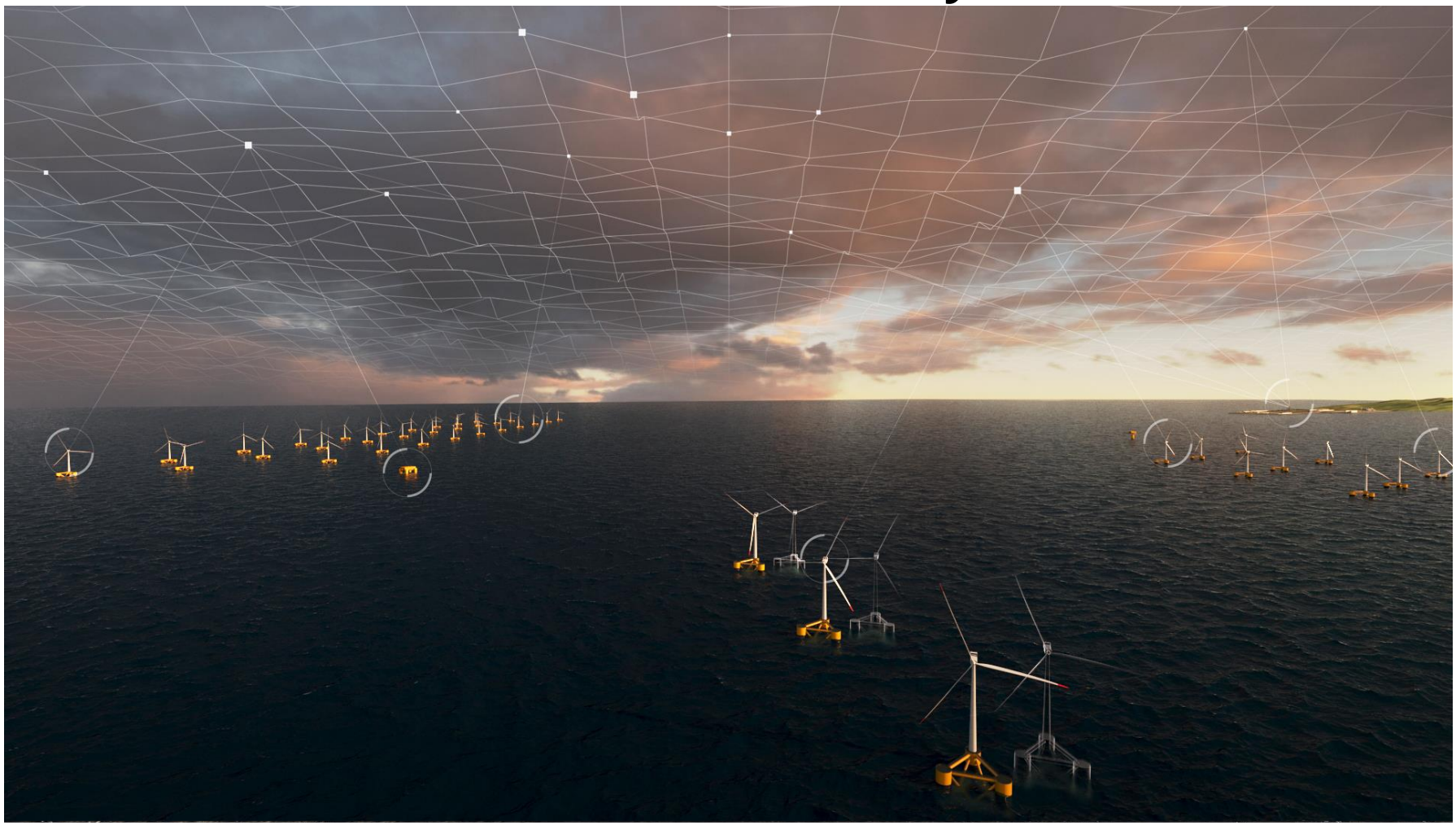
Demo-Scale: 25-30 MW, 8 MW Turbines
First Commercial: 300 MW, 9-10 MW Turbines
Mature Commercial: 600 MW, >12 MW Turbines

Adjusted Strike Price (EUR/MWh)
Announced Fixed Projects vs WindFloat

Key Take Aways.

1. The Full lifecycle deployment of the WindFloat 1 has yielded lessons learned that are already incorporated into our Gen 2 and Gen 3 design
2. Floating Offshore Wind: The WindFloat is a proven and advanced technology, and is immediately ready for commercial deployment
3. With over 150 MW of floating projects operating by 2020/21 (PPi >50% market share), We are ready for Going Global
4. Our main focus is on developing partnerships and supply chains to deliver the most competitive projects, worldwide
5. the post-prototype market is emerging, and it's going to be about Floating offshore wind…

Technologies such as the WindFloat can play a key role in fast tracking our energy transition to a zero-carbon humanity



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Merci !

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