

Principle Power

DeepWind Floating Substructure Workshop

Cian Conroy

April 2021



Globalizing
floating wind





Principle Power: Company introduction

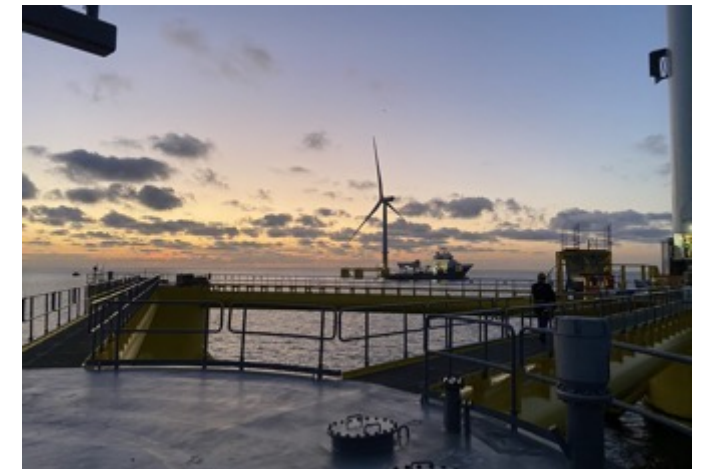
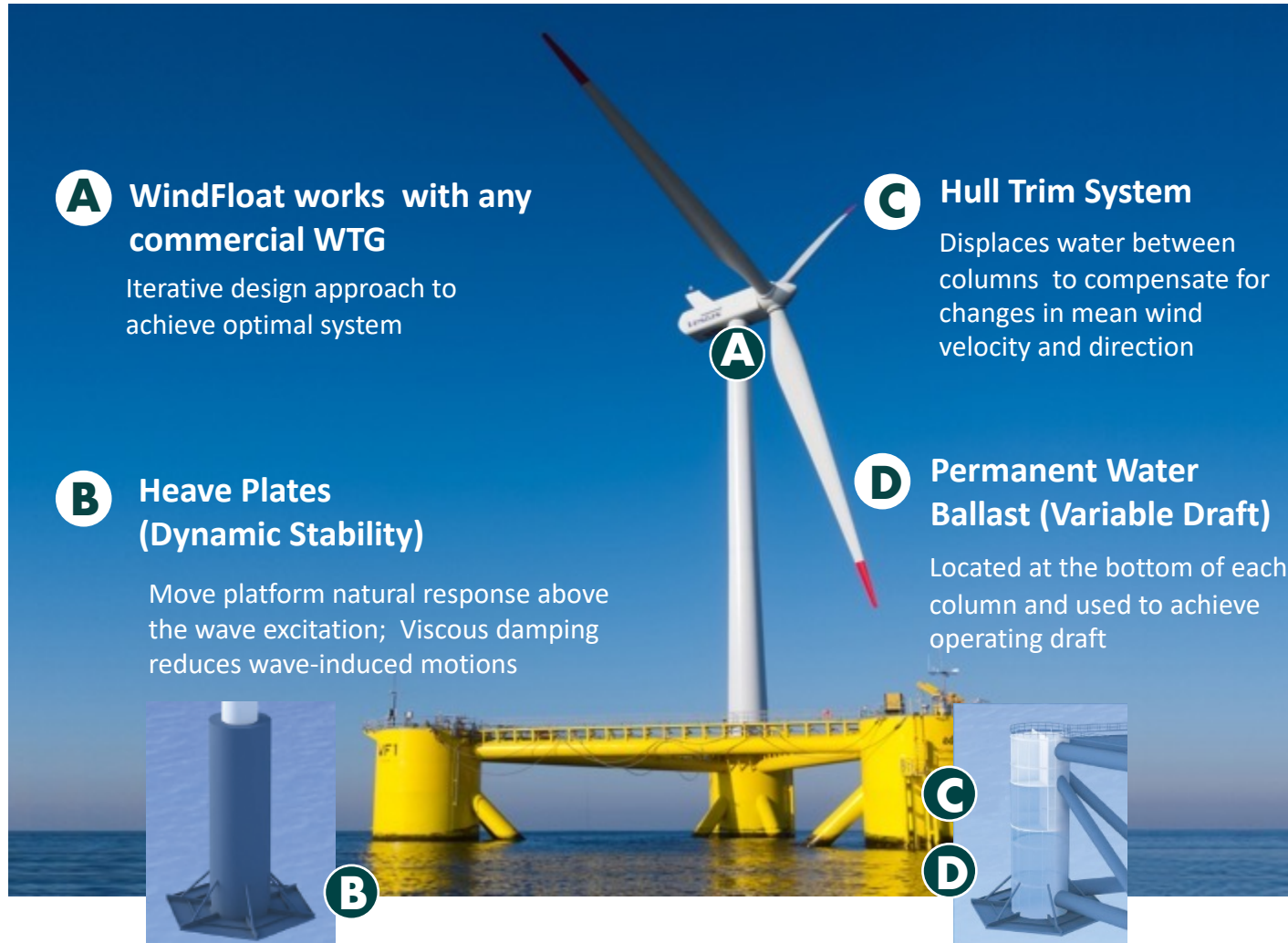
- Founded in 2007, Principle Power has grown to be a global leader in the floating offshore wind industry
- Headquarters in California with offices in Portugal, France, UK, Japan
- Globally patented floating platform: WindFloat
- Proven technology in multiple ocean environments
- Generated over 65 GW Hours
- Two operational windfarms
- Global portfolio



WindFloat Atlantic unit at quayside in Ferrol, Spain, August 2019



Our solution – the WindFloat® floating foundation

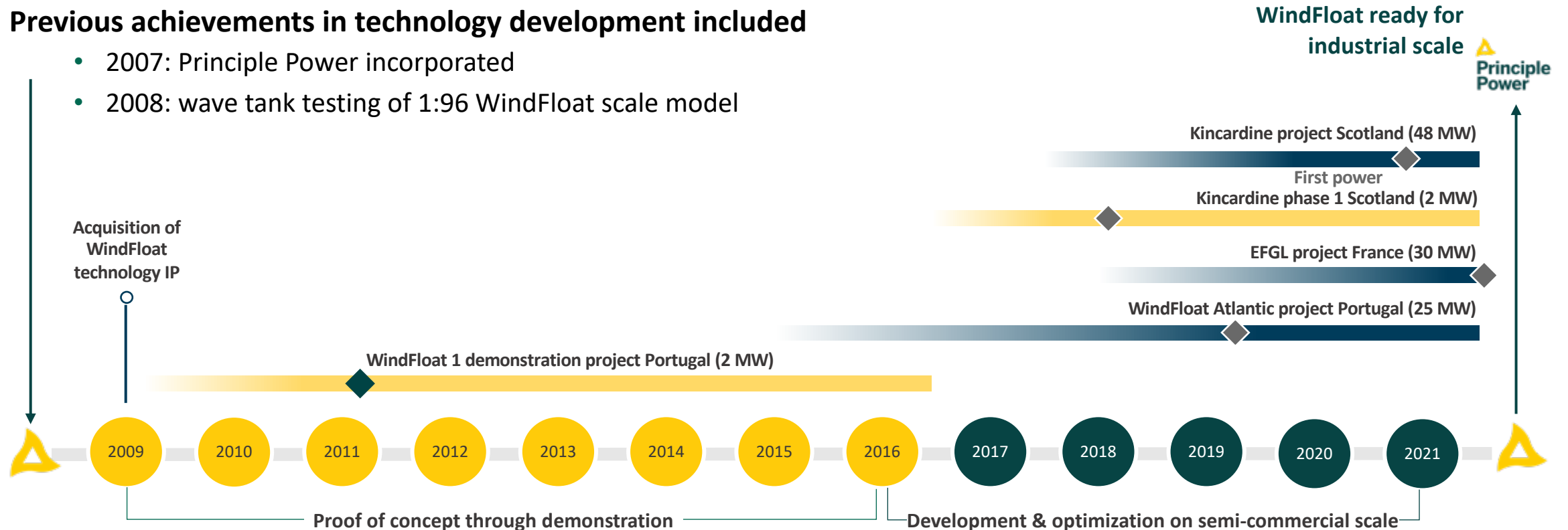




Successful company history taking a step by step approach to commercialization and industrial readiness

Previous achievements in technology development included

- 2007: Principle Power incorporated
- 2008: wave tank testing of 1:96 WindFloat scale model





WindFloat Atlantic is fully commissioned, proving the technology at full scale



WindFloat Atlantic - 25 MW, 2019

- Operating since 2019
- 3x 8.3 MW Vestas
- Local Shipyard Construction
- 20 km out; 100 m deep
- First Bank Financed Floating Wind Farm





WindFloat Atlantic serves as a springboard for the industry

Precommercial projects provide indispensable lessons for future commercial projects

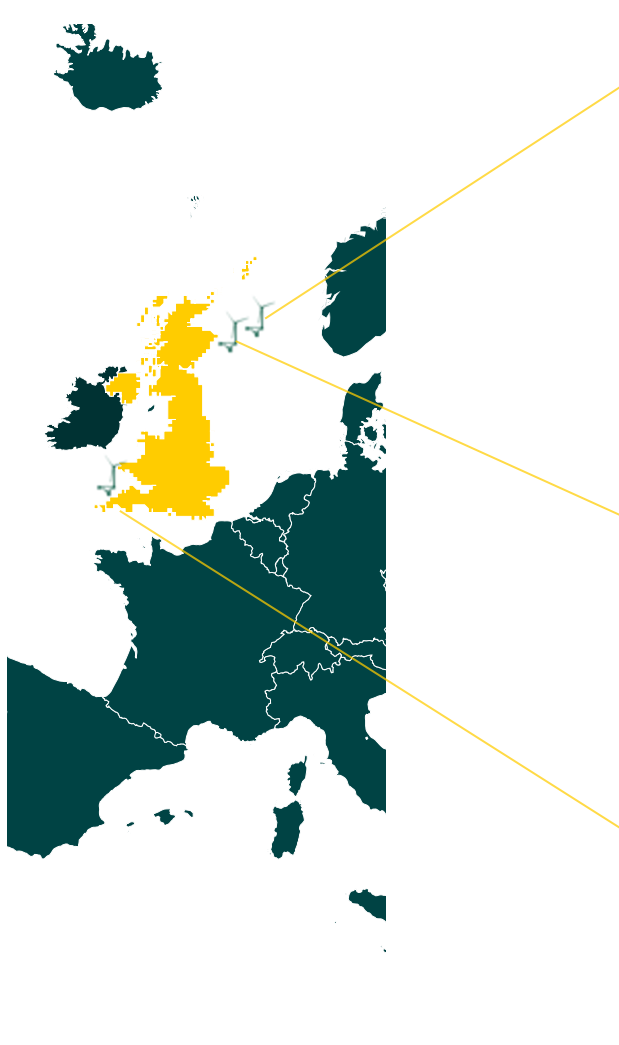
Lessons Learned

1. Empirical data increase design confidence and bankability
2. Interface between floating foundation designer and WTG is highly important;
3. Refinements gained through experience:
 - Design choices and fabrication methods
 - Logistics processes and specification of enabling equipment
 - Engineering workflow
 - Contract structure & risk management





WindFloat[®] UK: Kincardine, Dolphyn & Erebus



WindFloat Kincardine (Scotland) 50MW:

Retrofit of WF1 followed by 48MW more;

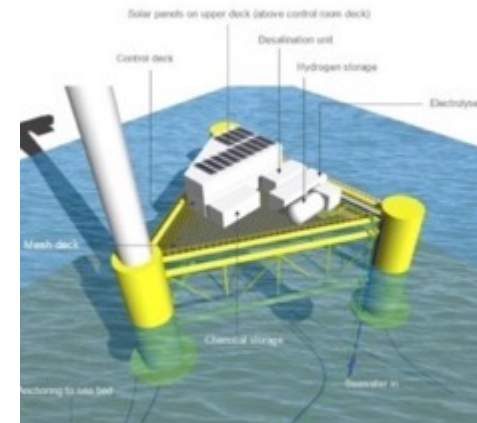
5 x 9.5 MW Vestas V164

- Location: 15 km off Aberdeen; ~60m depth
- Phase 1: WF1 Installation - Summer 2018
- Phase 2: Under construction, 2 x 9.5 MW units installed (Jan 21)



ERM Dolphyn (Scotland),

- Floating Hydrogen production
- 2MW and 10MW system
- Generating alternative revenues
- Relieving grid constraints



Erebus (Wales), 96 MW:

- COD 2027
- 45 km off the South West coast of Pembrokeshire





WindFloat[®] Technology Development Path

France: Les Eoliennes Flottantes Du Golfe Du Lion (EFGL)

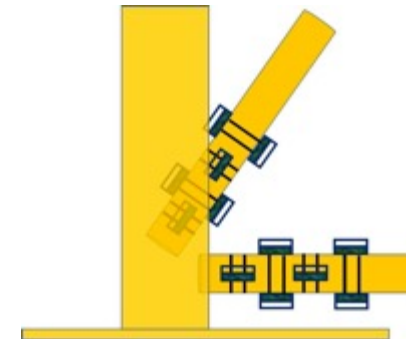


30MW, France, Operational 2022

- 3 x 10 MW
- 18 km out; 70-100 m deep
- Certified by BV
- Feed-In Tariff (through competitive process)
- Important innovations in modularisation and manufacturability to further increase deliverability and competitiveness
- Deploying fish nursery habitats (Biohuts) on WindFloat



GROUPE





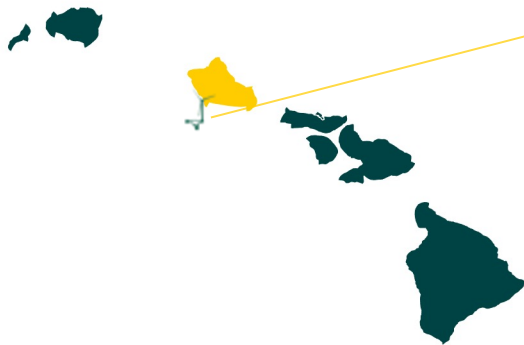
WindFloat[®] Technology Development Path

USA: Humbolt Bay California, Progression Energy Hawaii



Humbolt Bay (USA) ~150MW:

- 100-150 MW, Humboldt County, California,
- 30 km off California
- 700-900 m deep
- Wind resource (9.5+ m/s)



Progression Energy (USA) 400MW:

- 400 MW, Oahu, Hawaii
- Location: 20 KM southeast West Oahu
- Water depth 500 – 1000M

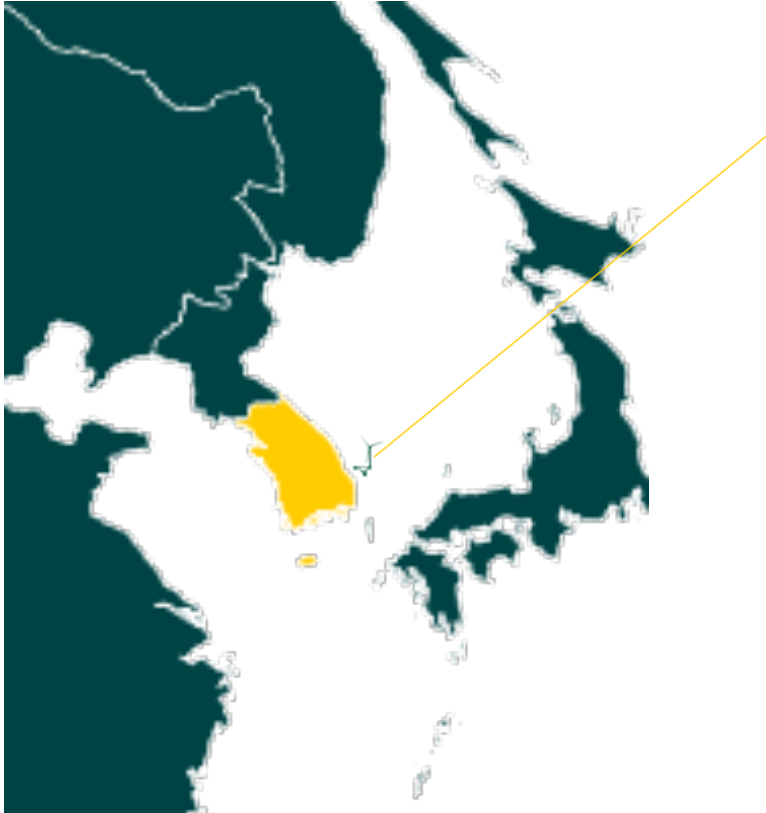


progression
energy™



WindFloat[®] Technology Development Path

South Korea: Ulsan City



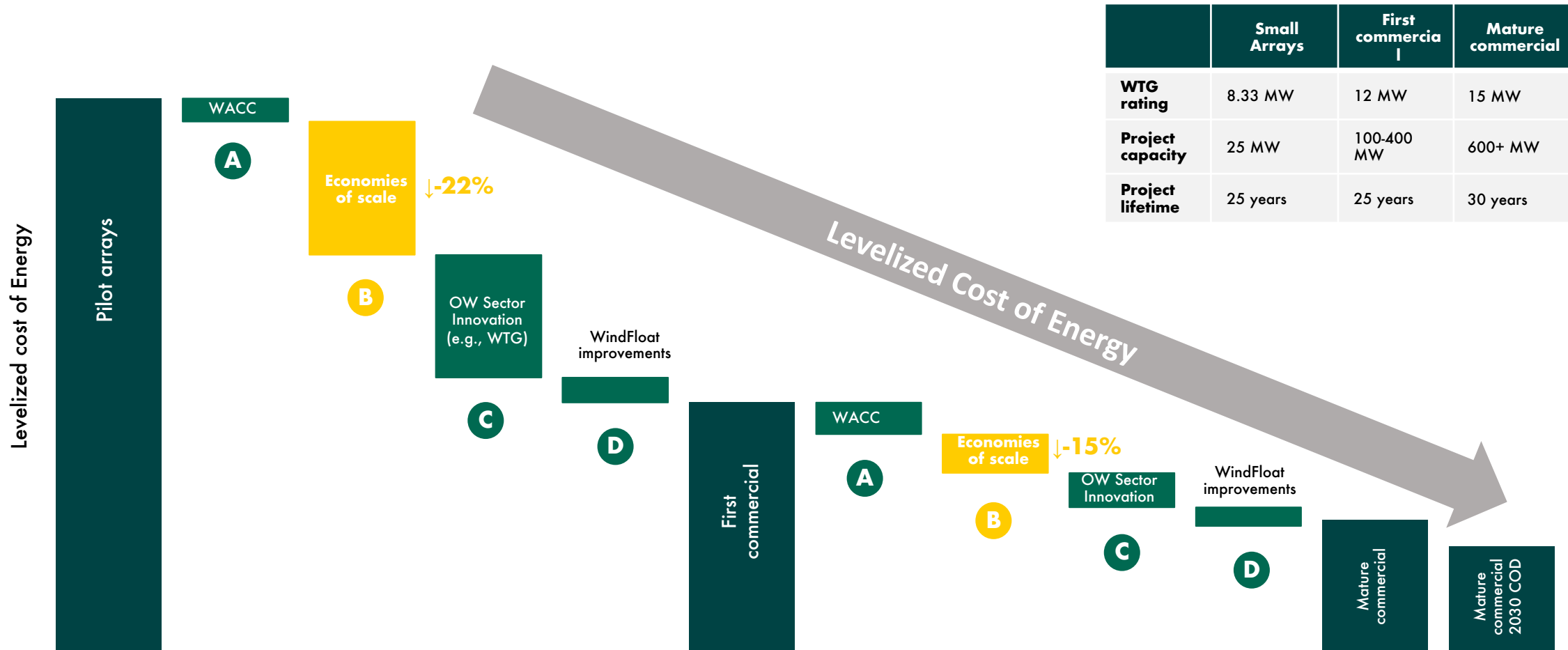
Ulsan City (South Korea) 2X500MW:

- South Korea target 13GW offshore by 2030
- Phase One: 500MW
- October 2020 Floating LiDARs Deployed
- COD 2027





Clear pathway towards cost competitiveness, however, achieving project (and sector) scale is a prerequisite



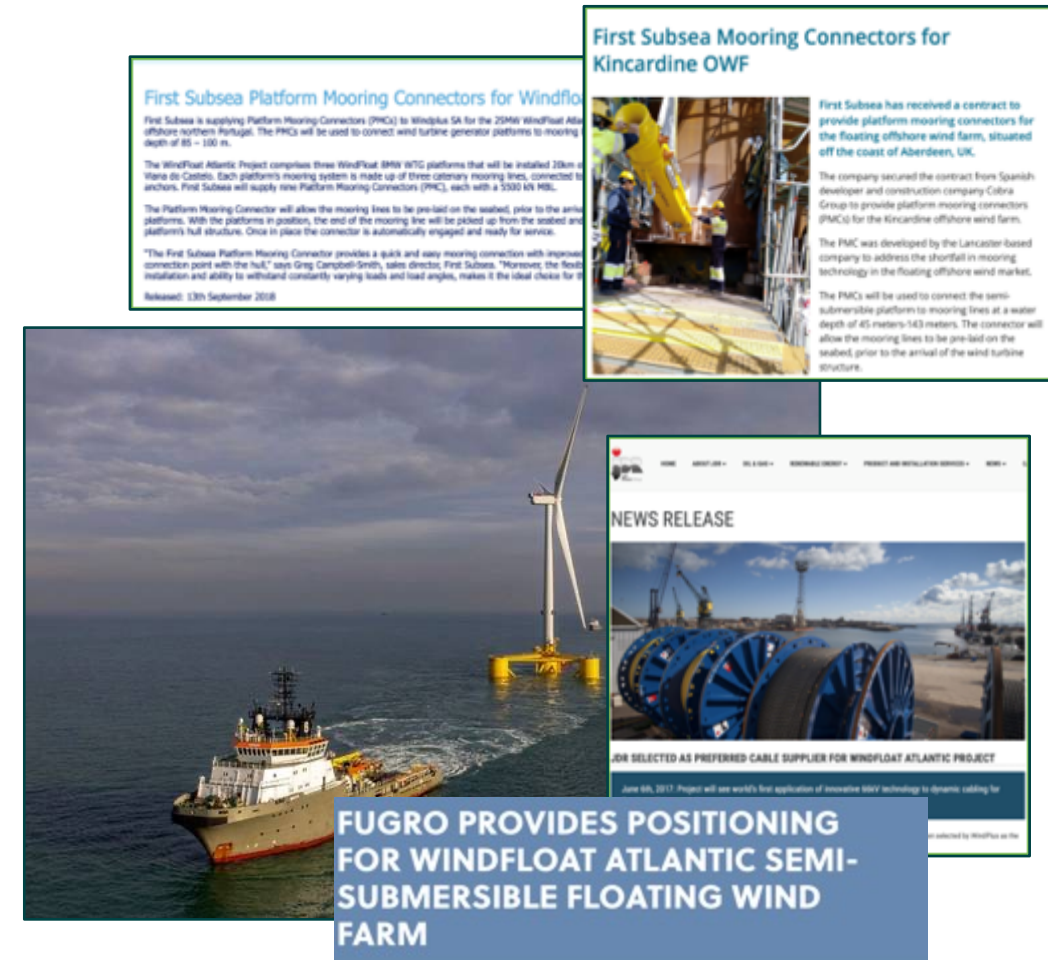
Timing depends on political and regulatory conditions enabling such projects (e.g., site control, permitting, and offtake support)



Supply chain – Requirements

The WindFloat technology stems from 60 years of O&G

- Incremental innovation
- Performance
- Risk
- Bankability
- Volumes/Industrialisation



Fugro has completed a positioning support contract for Bourbon Subsea Services (Bourbon) to help install the three units of the WindFloat Atlantic semi-submersible floating wind farm.



Preparing for Industrialization: understanding the challenge

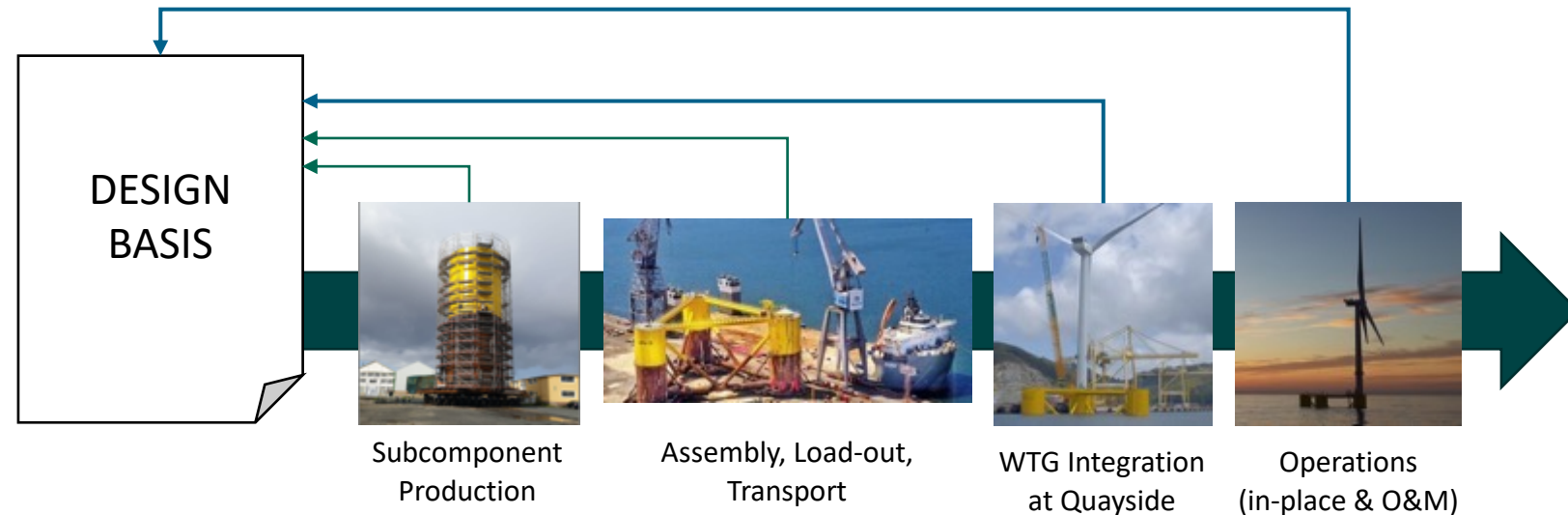
Commercial scale project requirements are very different than precommercial projects

Project Execution Plan Requirements:

- >100k tons of fabricated steel
- >100 mooring legs
- Installed in 1-2 years

Selection of Design Basis Constraints:

- Site Conditions
- WTG Technology
- Class Requirements
- Fabrication Yard Capabilities & Limits
- Local Content Requirements
- Temp. Limitations (e.g., quayside draft)







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