Stepping Stone Markets for Floating Foundations

Lessons in technology commercialization

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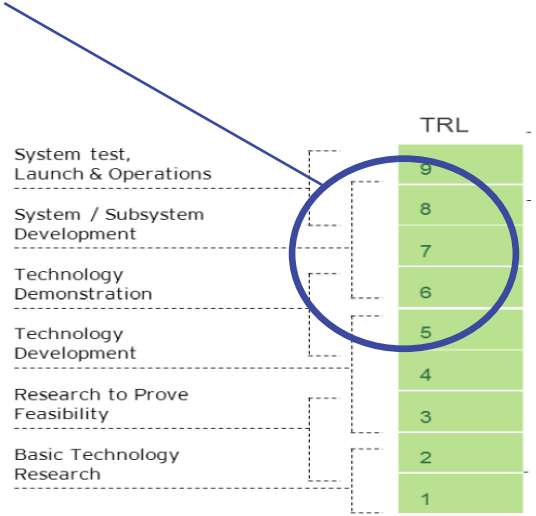
BVGassociates

Technology and Commercial Readiness

Relationship between technology development and commercial launch

Floating foundations state of the art

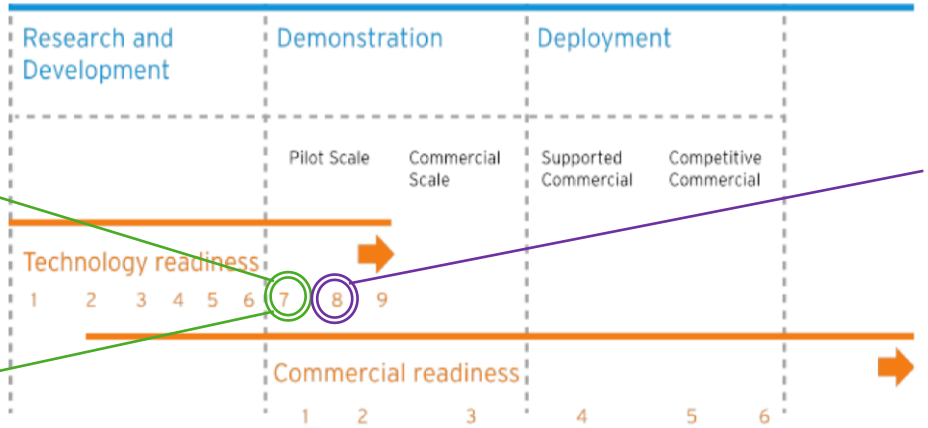


Technology and commercial readiness

Demonstration projects are commercial projects

1 unit @ 2.3 MW

1 unit @ 2 MW



1 unit @ 7 MW

CRI 1: Hypothetical commercial proposition: Technically ready; commercially untested and unproven.
CRI 2: Commercial trial: Small scale, first of a kind project funded by equity and government project support.
CRI 3: Commercial scale up occurring driven by specific policy and emerging debt finance.

Product-Market Fit

Is the product solving a burning need, or is it a 'nice-to-have'?

The product comes in several sizes

Minimum viable product
Smallest/cheapest product that delivers evidence of:
• Technically viability
• Commercially viable
→2 to 7 MW single unit demonstrator with a power purchase agreement

Commercial trial
Pilot projects with multiple units
(e.g., Hywind Scotland, WindFloat Oregon)

Commercial scale-up
10 to 20 units (50 to 100 MW)

Multiple commercial applications
Several projects at hundreds of MW each

Product features

Ideal value proposition:

"Floating wind turbines are a critical enabling technology for generating affordable, secure, clean, and reliable energy in regions with deep-water coastlines."

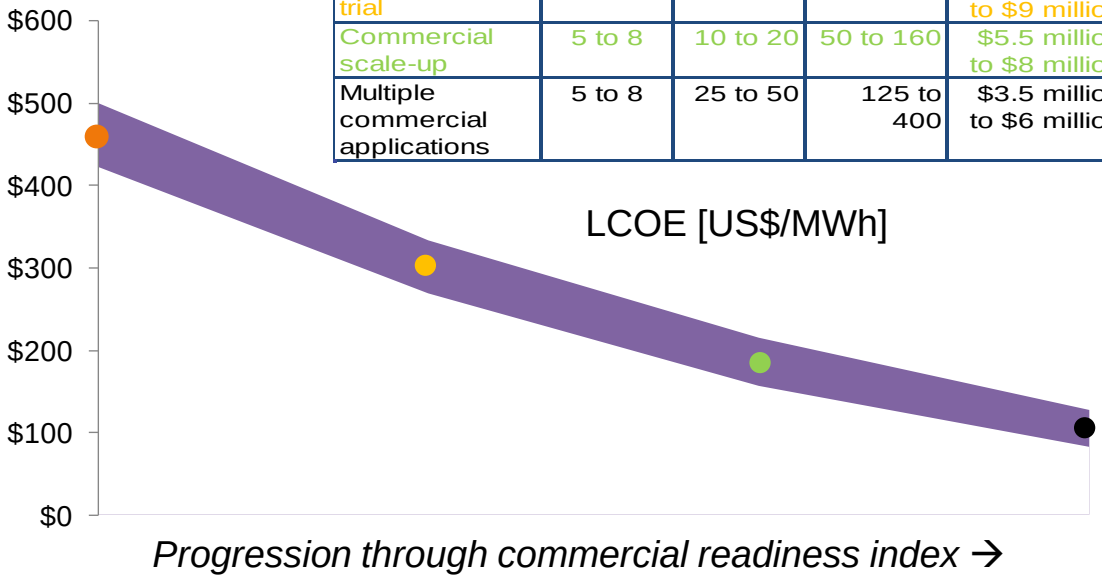
✓ **Secure**
✓ **Clean**
? Affordable
? Reliable

• Cost profile is dramatically different across the product line
• Reliability is proven through incremental track record

Product-Market Fit

Cost profile during scale-up

Commercial readiness index	Turbine rating (MW)	Number of turbines	Project rating (MW)	CAPEX per MW	Annual OPEX per MW	Capacity factor	WACC	LCOE low ($/MWh)	LCOE high ($/MWh)
Minimum viable product	2 to 7	1	2 to 7	$9 million to $11 million	$250,000	35%	12%	$ 423	$ 500
Commercial trial	5 to 8	5 to 10	25 to 80	$7 million to $9 million	$175,000	42%	12%	$ 269	$ 333
Commercial scale-up	5 to 8	10 to 20	50 to 160	$5.5 million to $8 million	$125,000	48%	10%	$ 157	$ 215
Multiple commercial applications	5 to 8	25 to 50	125 to 400	$3.5 million to $6 million	$90,000	50%	8%	$ 82	$ 127



Product-Market Fit

Electricity market profiles

Region	Evidence of support for floating turbine development	'Hurdle price'	Total installed generation
France	4 test zones and significant R&D expenditures	$110/MWh	120,000 MW
Maine (USA)	Offshore test zone and special offtake subsidy	$80/MWh	3,000 MW
Japan	Test sites and significant R&D expenditures	$150/MWh	245,000 MW
Scotland	Test site and offtake subsidy	$100/MWh	13,000 MW

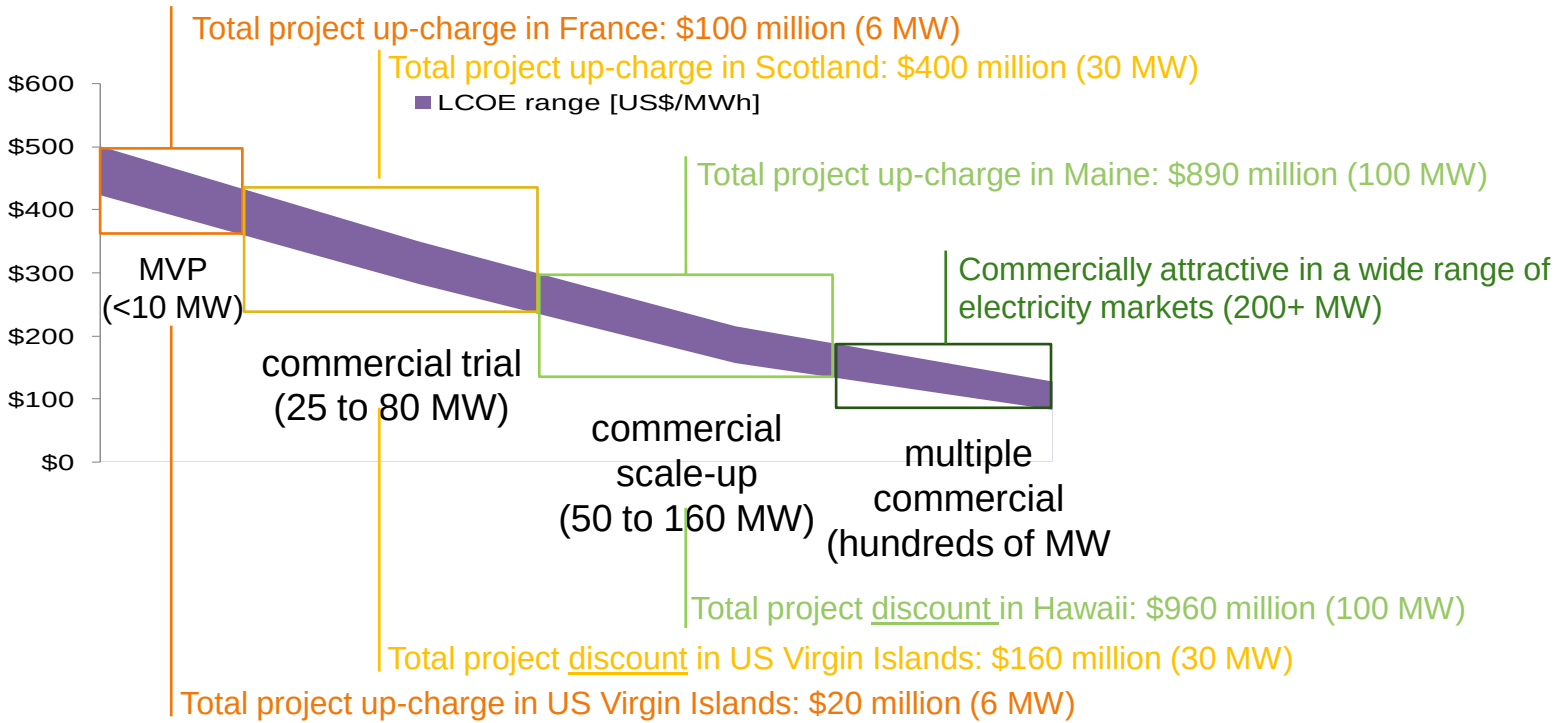
Markets buy large quantities of inexpensive power

Region	Evidence of support for renewables	'Hurdle price'	Total installed generation
US Virgin Islands	Goal: 30% renewable by 2030	$375/MWh	216 MW
Antigua and Barbuda	Goal: 15% renewables by 2030	$300/MWh	118 MW
Bahamas	Goal: 30% renewable by 2030	$250/MWh	536 MW
Hawaii	Mandate: 100% renewables by 2045	$300/MWh	3,000 MW

Markets buy small quantities of expensive power

Product-Market Fit

The right product for the right market



Conclusions

Creating the right ecosystem within the offshore wind industry

For technology developers…

- Embrace the commercial nature of demonstration projects
- Develop a value proposition for each stage of your journey, not just the end game
- *“A great technology does not a business make”*

For established firms…

- The classic venture capital model does not work for energy hardware
- Your strategic investment is critical

For governments and policy makers…

- Support foreign demonstration projects to gain domestic benefits

For enablers…..

- Take a mission-based approach, rather than a regional approach

Thank you

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