

WIREC

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Marine Current Turbines: Pioneering Tidal Stream Technology

Peter Fraenkel - Technical Director - MCT Ltd

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The Court, The Green,
Stoke Gifford, Bristol BS34 8PD, UK.

www.marineturbines.com

SeaGen 1.2MW Commercial Prototype

- due for installation at end of this month
- soon to be tested in Strangford Narrows, Northern Ireland
- will be used as testbed for SeaGen technology
- will have continuous environmental monitoring



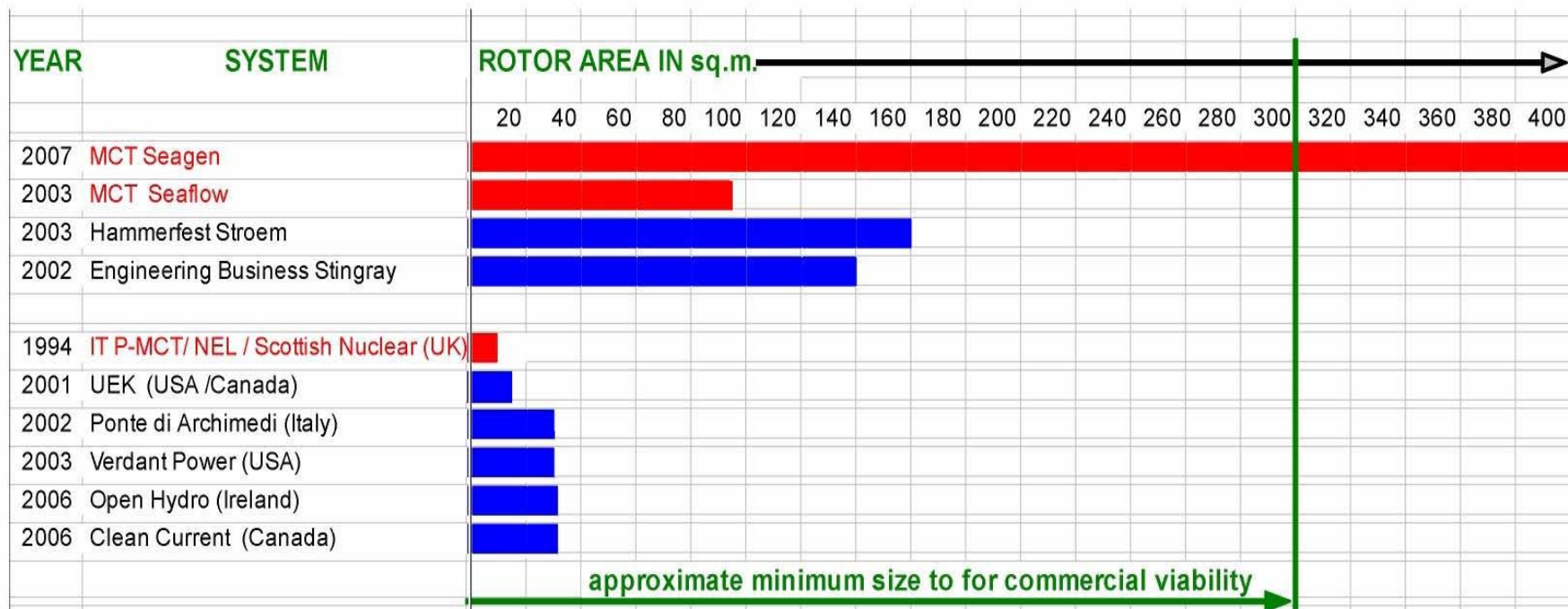
Decentralised Marine RE Systems*: *What do we need for commercial success?*

- 1. Scale** – must be 1MW or more to be economic
- 2. Access** – safe, affordable, reliable access for servicing
- 3. Reliability** – need to minimise costly intervention
- 4. Life** – several decades; otherwise not economic

... only a handful of technology developers are anywhere near to delivering technology to fit these criteria

* *i.e. wave and tidal stream energy systems*

State-of-the-art: comparison of rotor sizes

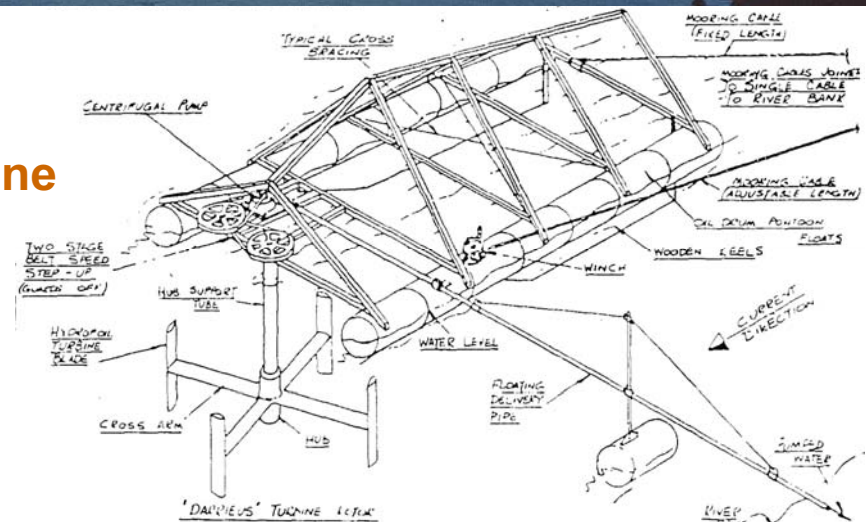


Note: the swept area of the rotors governs the energy capture at any given location

Background - River Current Turbines 1976-84



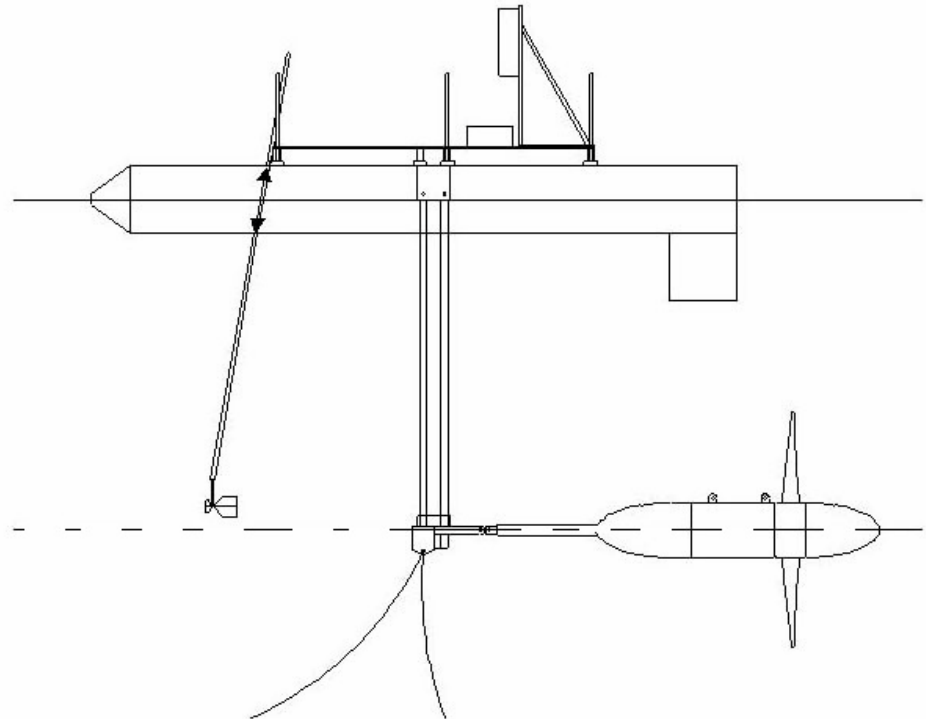
**ITDG / IT Power
River Current Turbine
development
(UK & Sudan)**



Background: 15kW Tidal Current Turbine (1994-5)

PROOF OF CONCEPT PROJECT
(IT Power. Scottish Nuclear & NEL)
Loch Linnhe, Scotland

World's first tidal current turbine



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Seaflow installed 30 May 2003

rotor dia. 11m

rated power 300kW

pile dia. 2.1m

water depth 24m ± 5m



Seaflow:

what has 'worked'
the basic concept

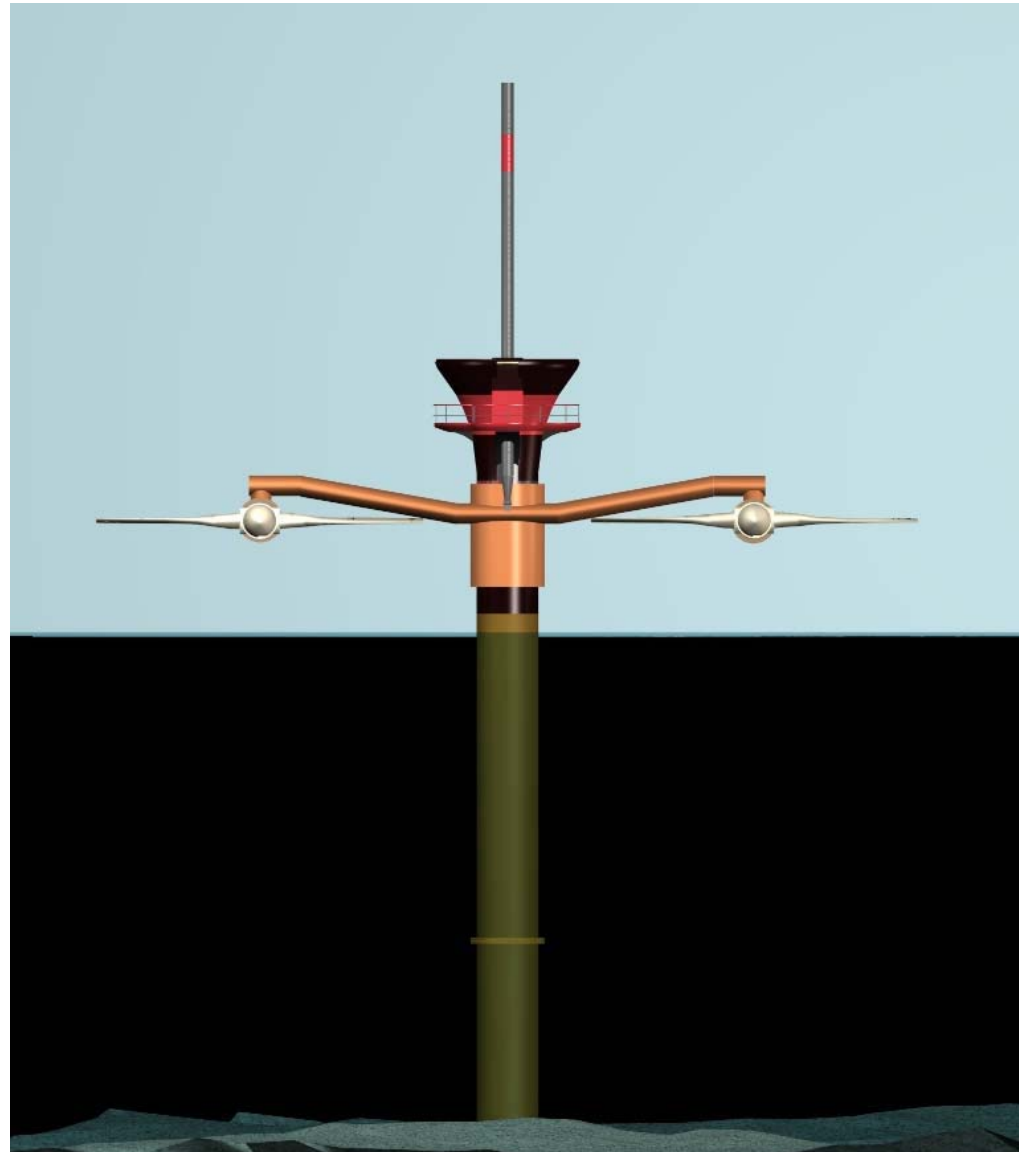
- Axial flow rotor
- Marinised drive train
- Surface breaking monopile
- Structural integrity
- Low cost intervention
- No significant environmental impact



SeaGen Prototype

Some key features:-

- ◆ 2 x 600kW rotors:16m dia.
- ◆ installed on steel pile
- ◆ rotors and nacelles raised above sea level for maintenance
- ◆ transformer and electrical connection to grid in accessible and visible housing at top of pile
- ◆ deployment in arrays or “farms”. of hundreds of turbines



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Rotor assembly at H&W - 16m diameter - 600kW



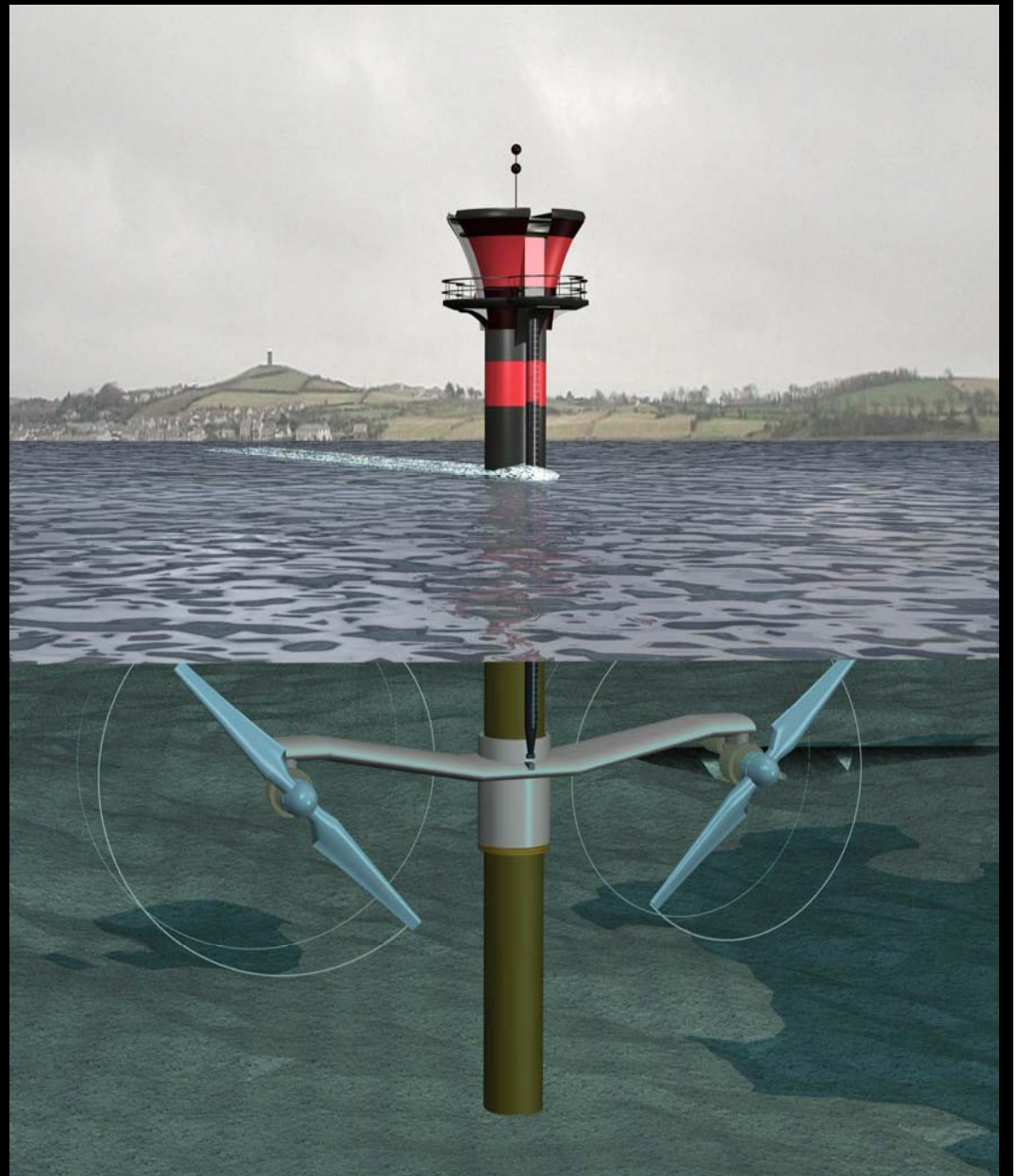
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**Seagen - complete and ready for installation
at Harland & Wolff, Belfast - April 2007**



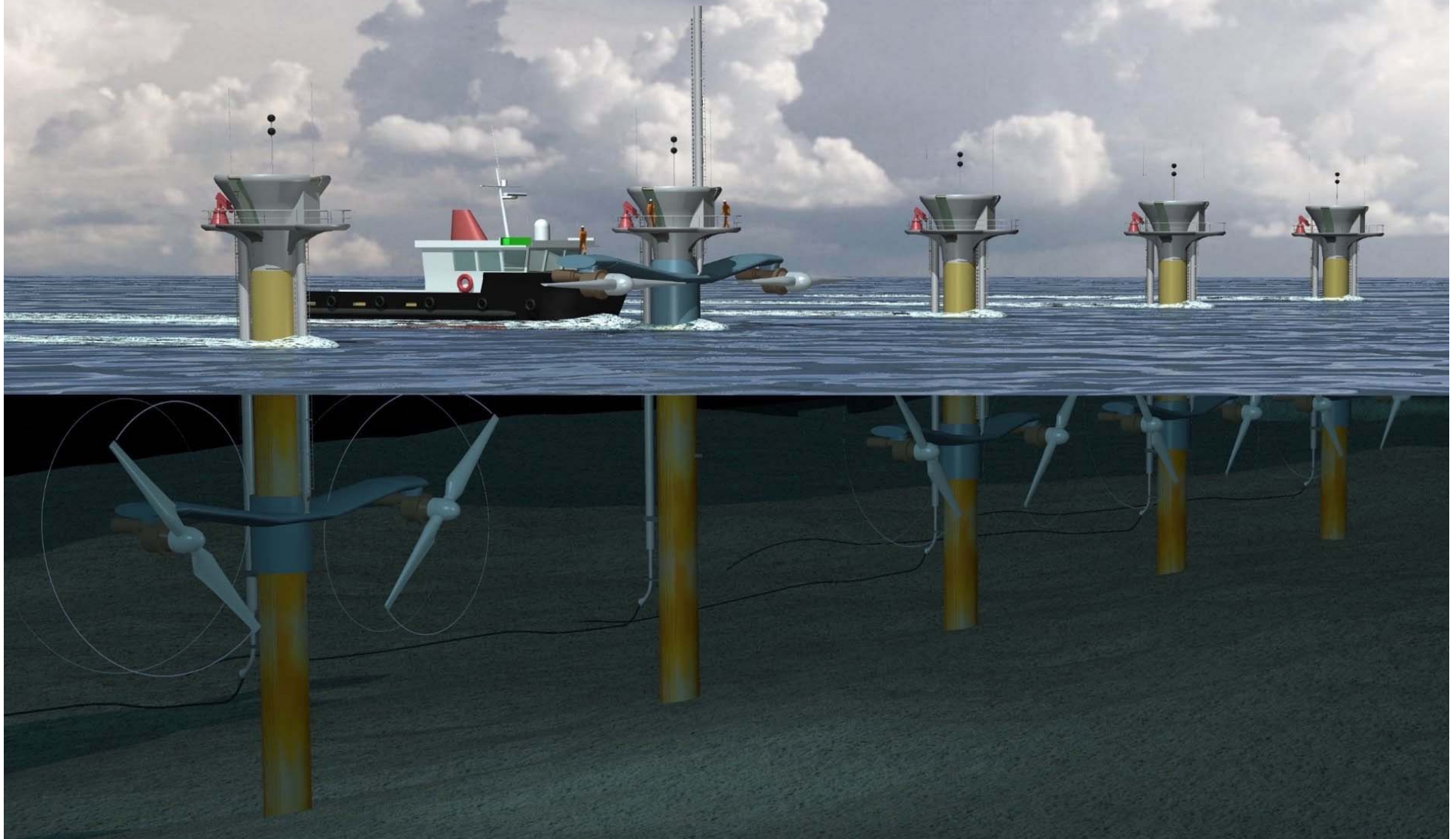
SeaGen 1.2MW Commercial Demonstrator

- soon to be tested in Strangford Narrows, NI
- will be used as testbed for SeaGen technology
- will have continuous environmental monitoring
- mean max current 7.8kt
water depth 25m \pm 2m



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Next stage - 10 MW Seagen Array - Anglesey Skerries - Wales



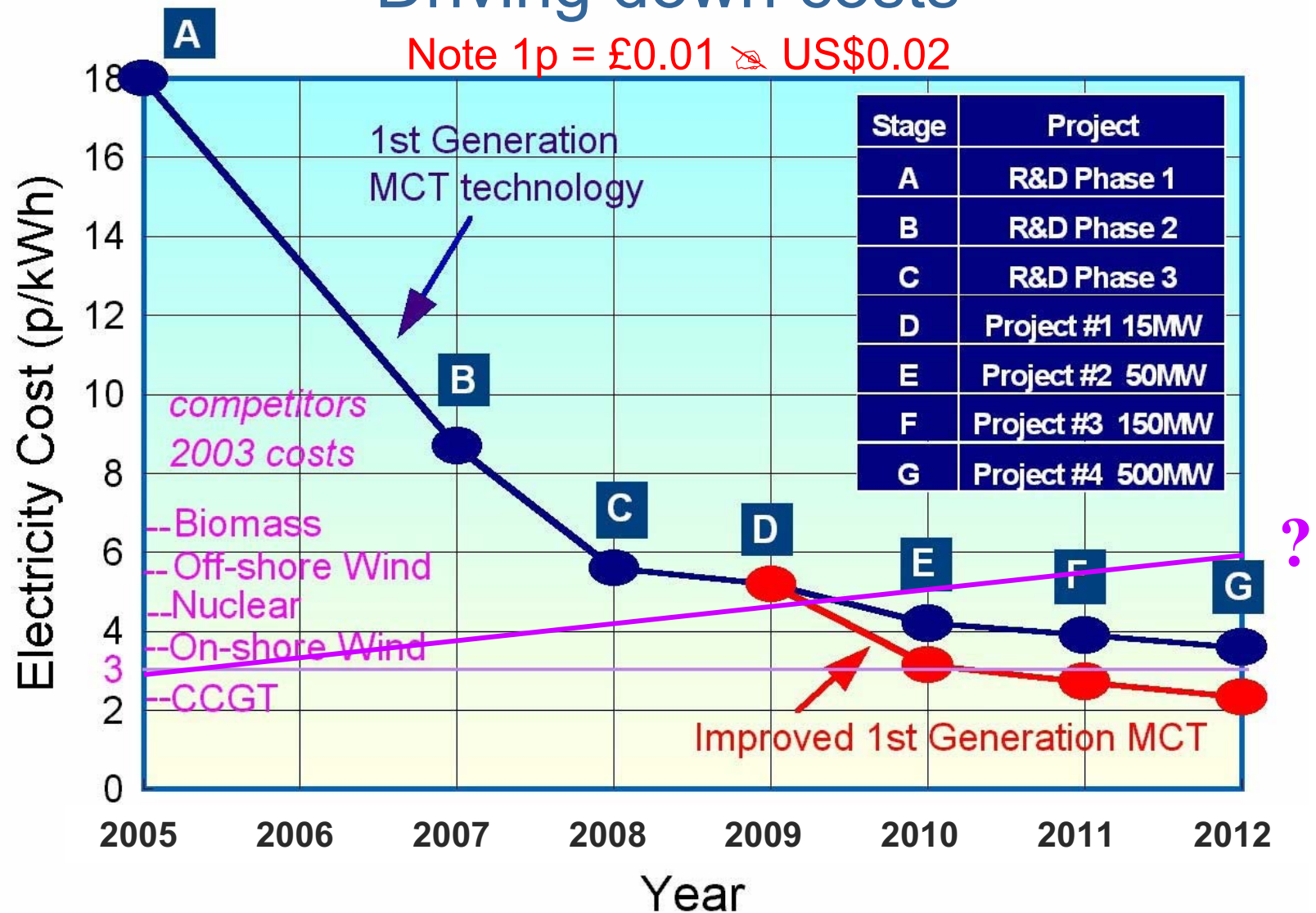
Marine Current Turbines Early Project Costs

| Location | Rated Power (MW) | Capital cost (£k/MW) | Life Cycle Unit cost (p/kWh) |
|--|-------------------------|-----------------------------|-------------------------------------|
| Strangford | 1.2 | 5,191 | 16.8 |
| Anglesey Skerries demo | 10.5 | 2,537 | 11.7 |
| Anglesey Skerries Commercial | 51.0 | 1,489 | 7.9 |
| Anglesey Skerries if developed fully (after 500MW installed) | 100 | 923 | 5.2 |

Life-cycle Unit Cost projections from due diligence report by Black & Veatch (assumes cost of capital at an 8% discount rate)

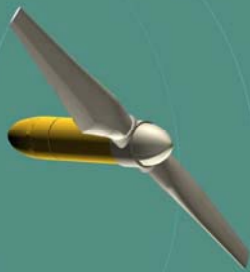
Driving down costs

Note 1p = £0.01 ✂ US\$0.02

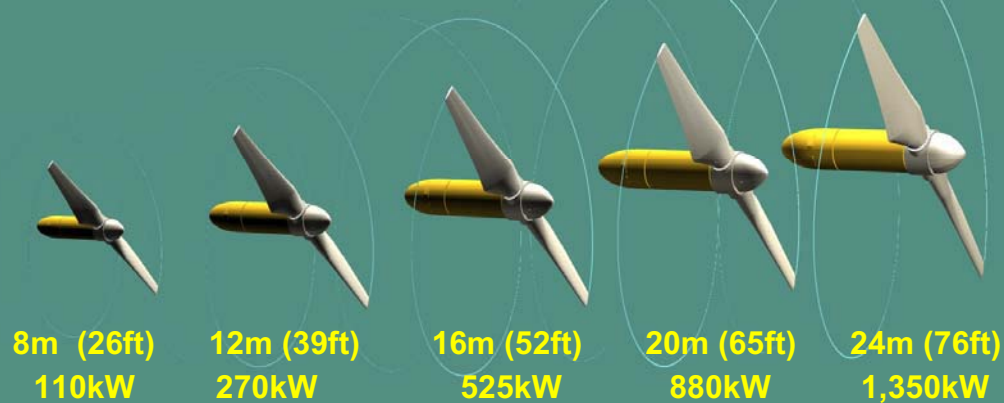


Route towards Second Generation Technology

1. develop a reliable power unit based on Seagen



2. Scale it up and down within reasonable limits



6 rotors of ----
give rating of ---

8m dia
0.66MW

12m dia
1.6MW

16m dia
3.1MW

20m dia
5.3MW

24m dia
8.1MW

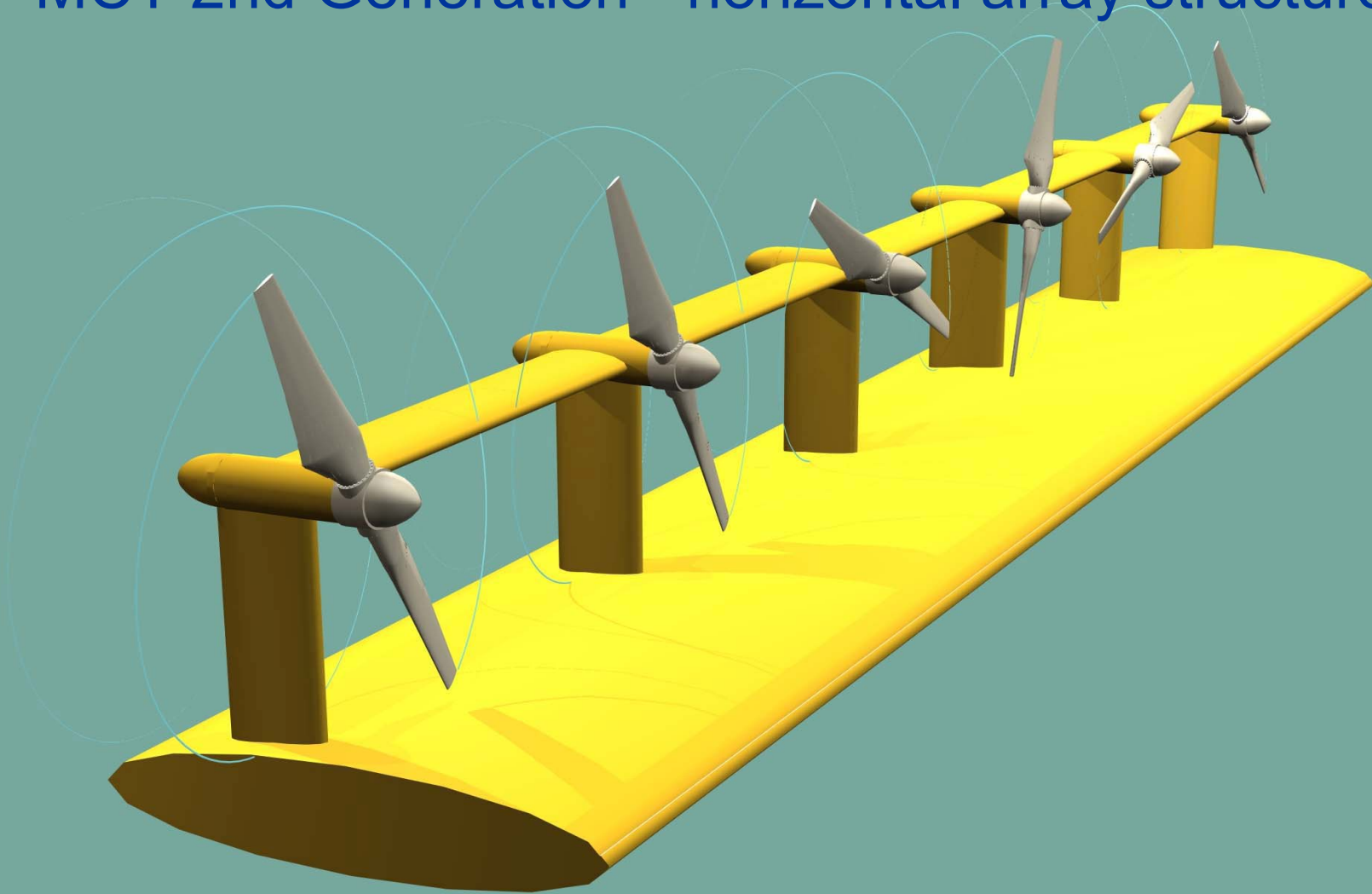
3. Deploy suitably sized array of rotors across current



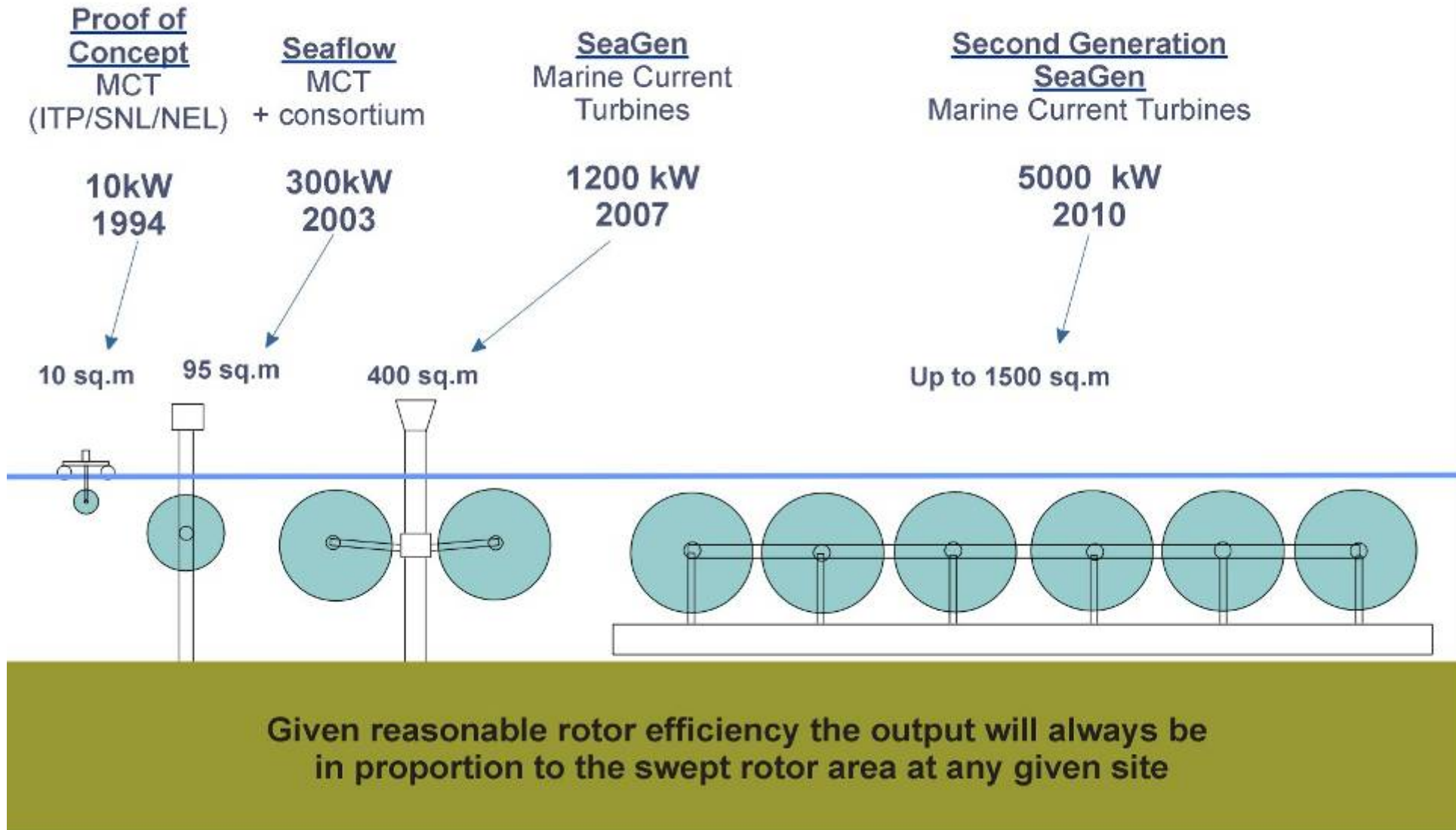
.... but we need to develop a suitable structure to hold them

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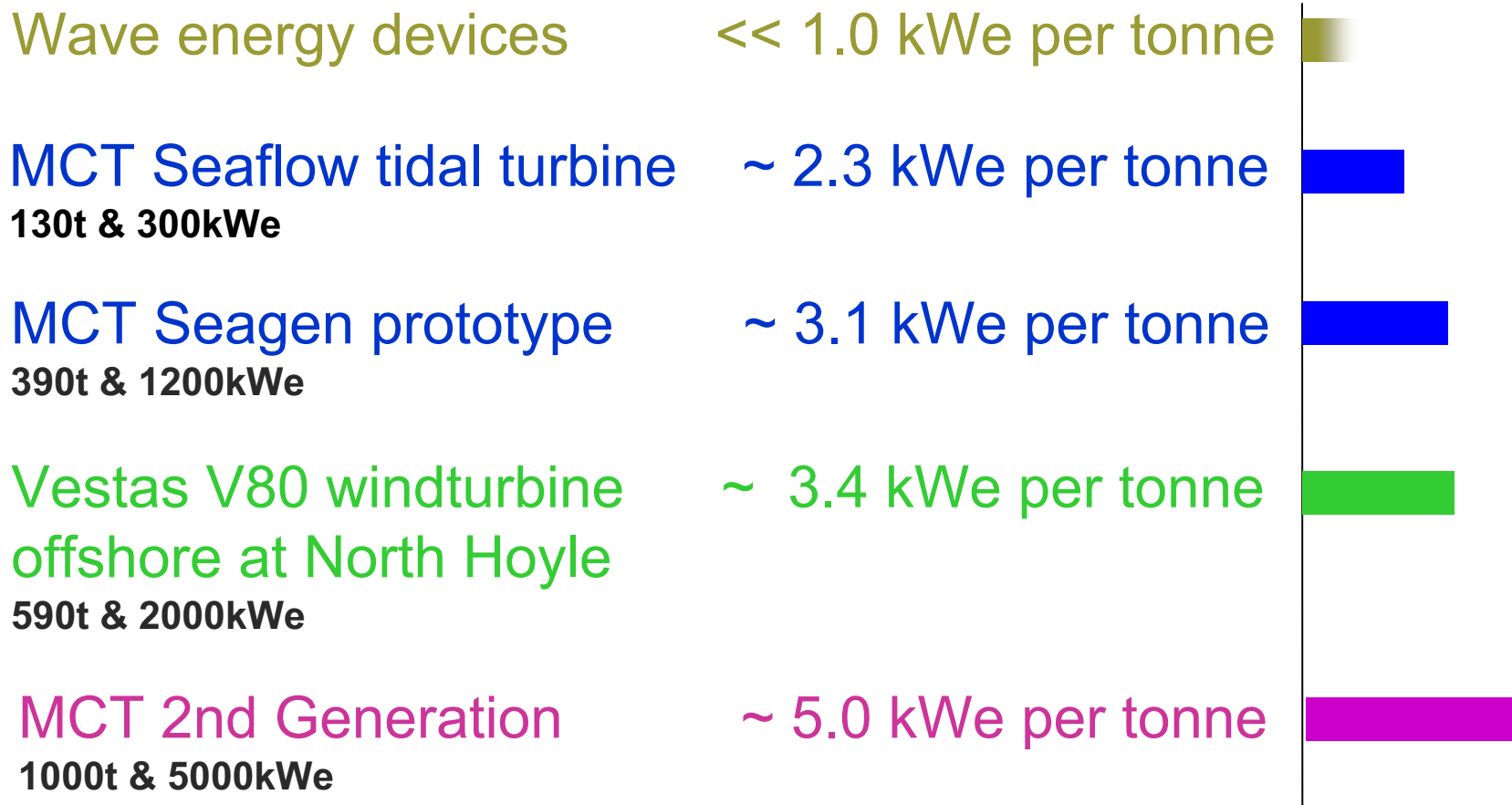
MCT 2nd Generation - horizontal array structure



Progressive development of tidal turbines by MCT



an indicator of cost-effectiveness **how many kW per tonne of equipment?**



Energy Matters

“... the momentous decisions we take in the next few years will determine whether our heirs thank us or curse us for the energy choices we bequeath to them.”

Alex Kirby, BBC News Online environment correspondent, 19 April 2004

Source: Dick Lawrence, *The Case for Modeling World Energy Flow*, World Energy Modelling, Berlin 2004

Marine Current Turbines Ltd

Bristol UK

<http://www.marineturbines.com>

tel: (+44 or 0) 117 979 1888

