BWEA Glasgow October 2006

Marine Current Turbines: from prototype to product

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

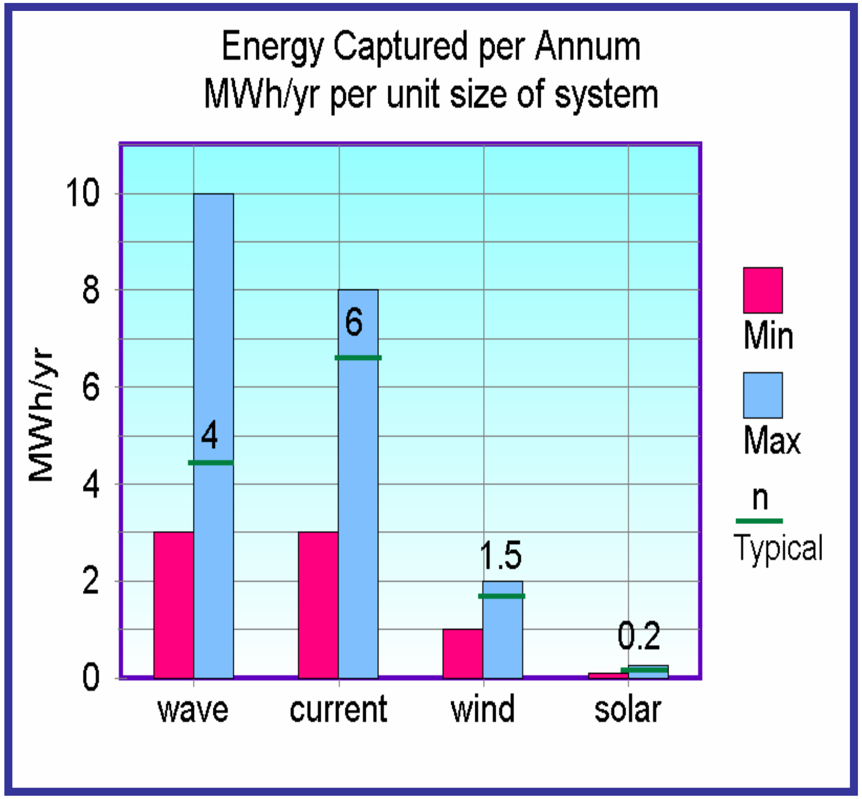
Why use marine currents?

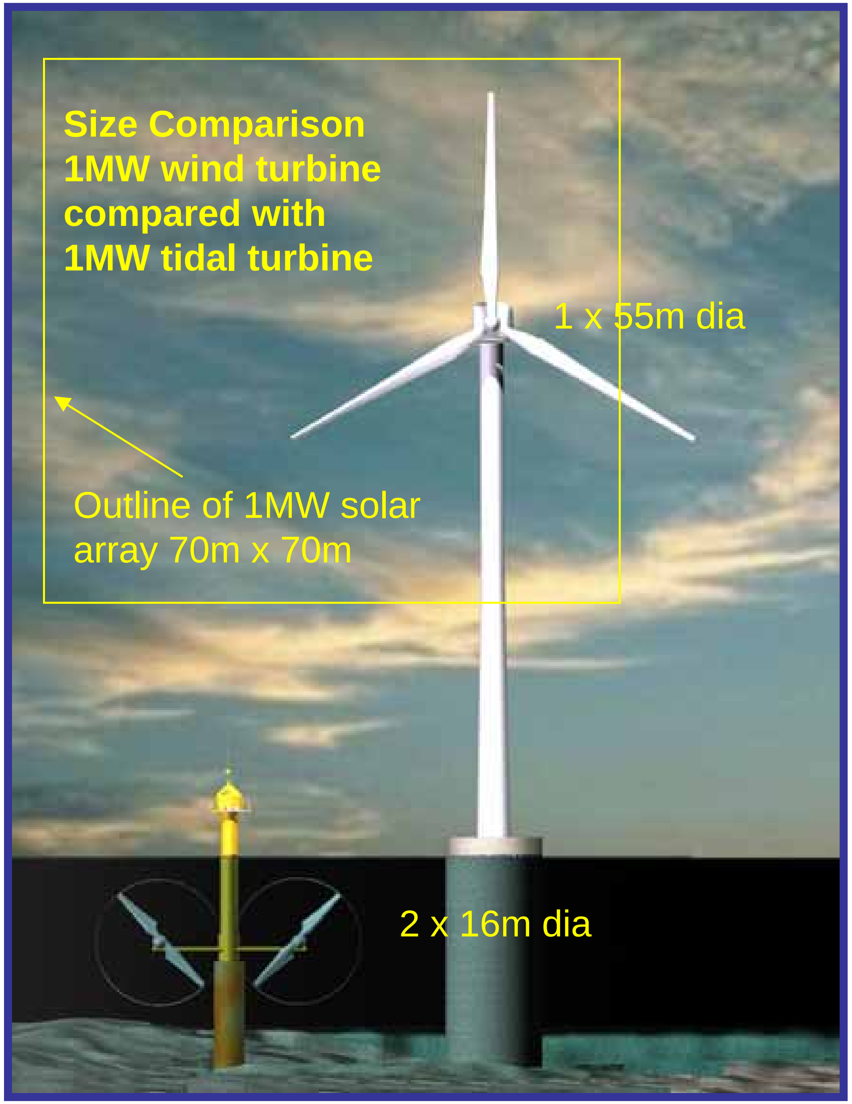
1. Large resource - too big to be neglected or ignored
2. Technical feasibility - rapid development is possible
3. Predictability - driven by gravity - not weather
4. Minimal environmental impact - and favourable ERoEI - <8mths
5. High Load Factor (works on both the ebb and the flood tides)

San Bernardino Straits - The Philippines
shown running at 3.5m/s or 7 knots

Marine currents = High energy intensity

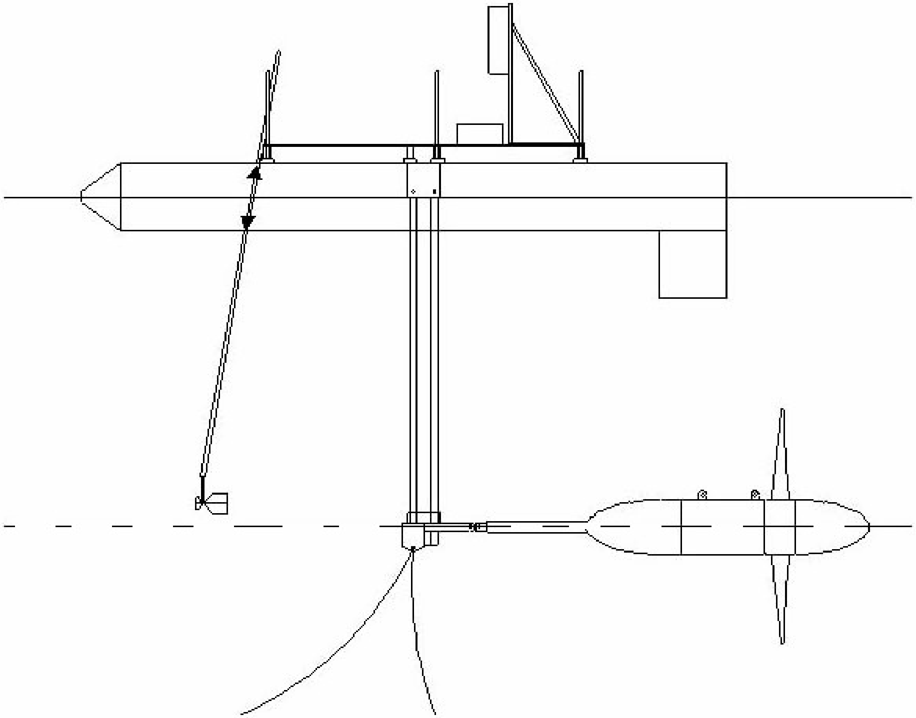
A tidal current turbine gains over 4x as much energy per m² of rotor as a wind turbine





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

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



Seaflow installed 30 May 2003

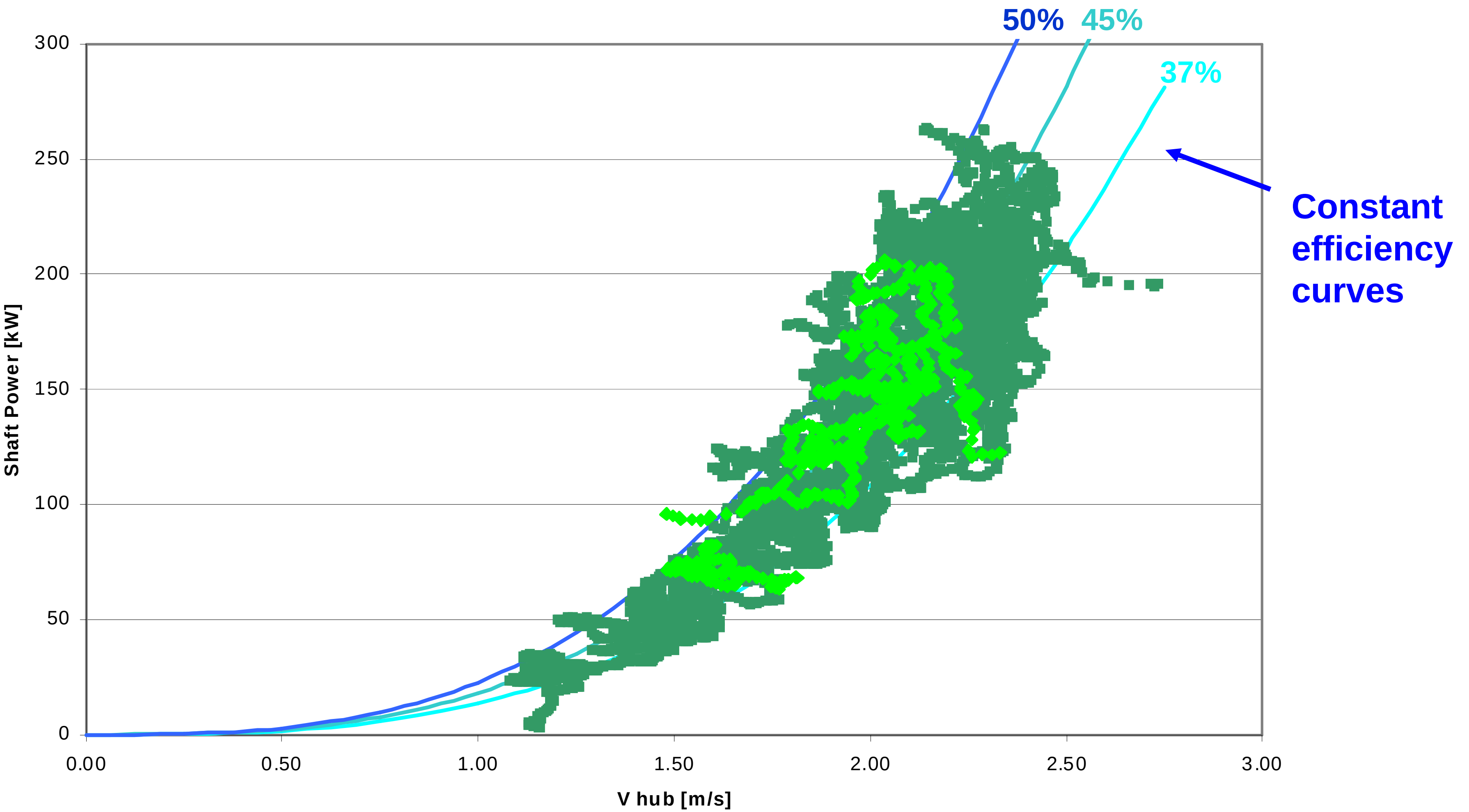
rotor dia. 11m
rated power 300kW
pile dia. 2.1m

operational

raised for access

Seaflow measured rotor performance

Turbine shaft power v current velocity at hub height



Seaflow: what has ‘worked’

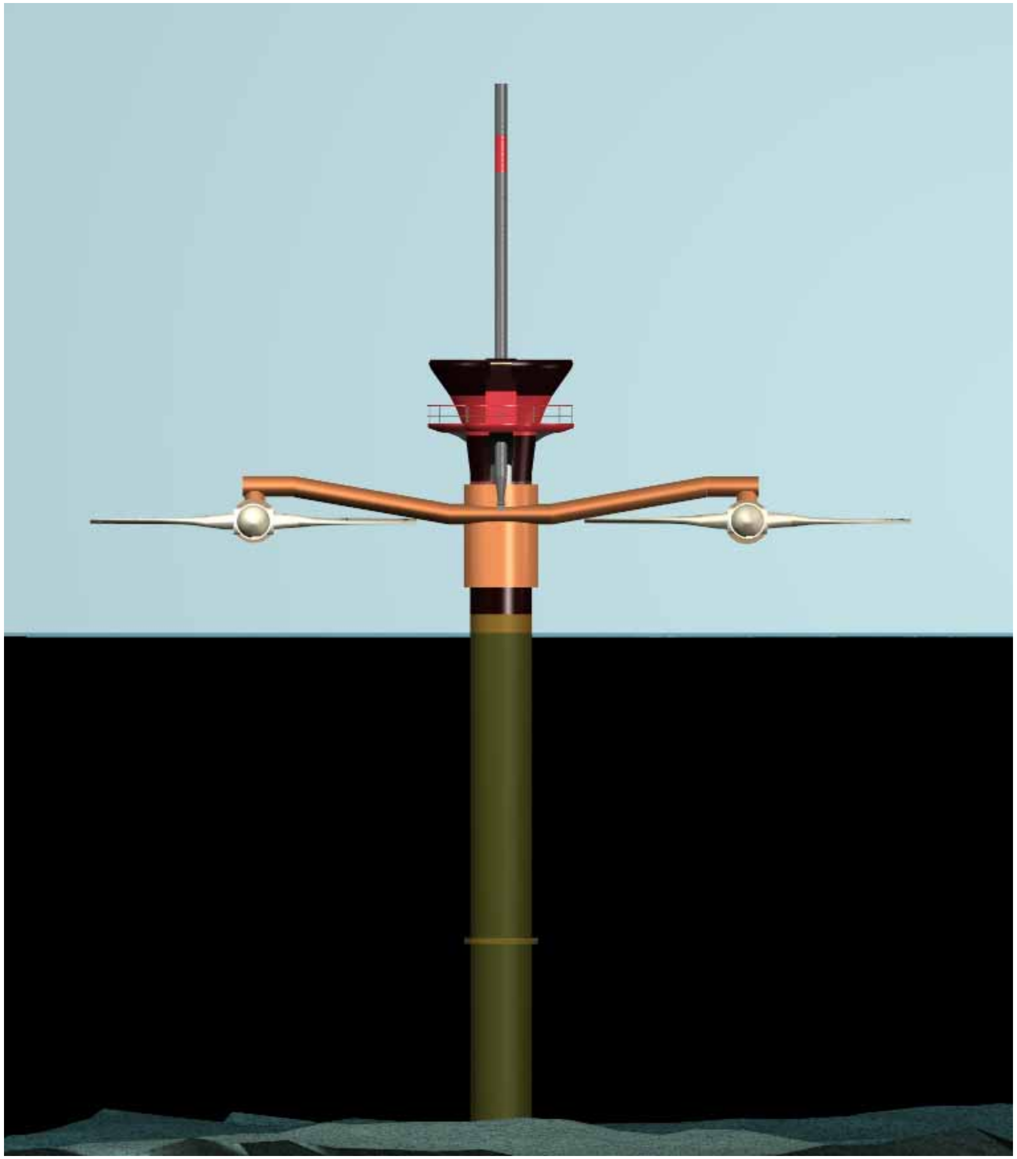
the basic concept

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

SeaGen Prototype

Some key features:-

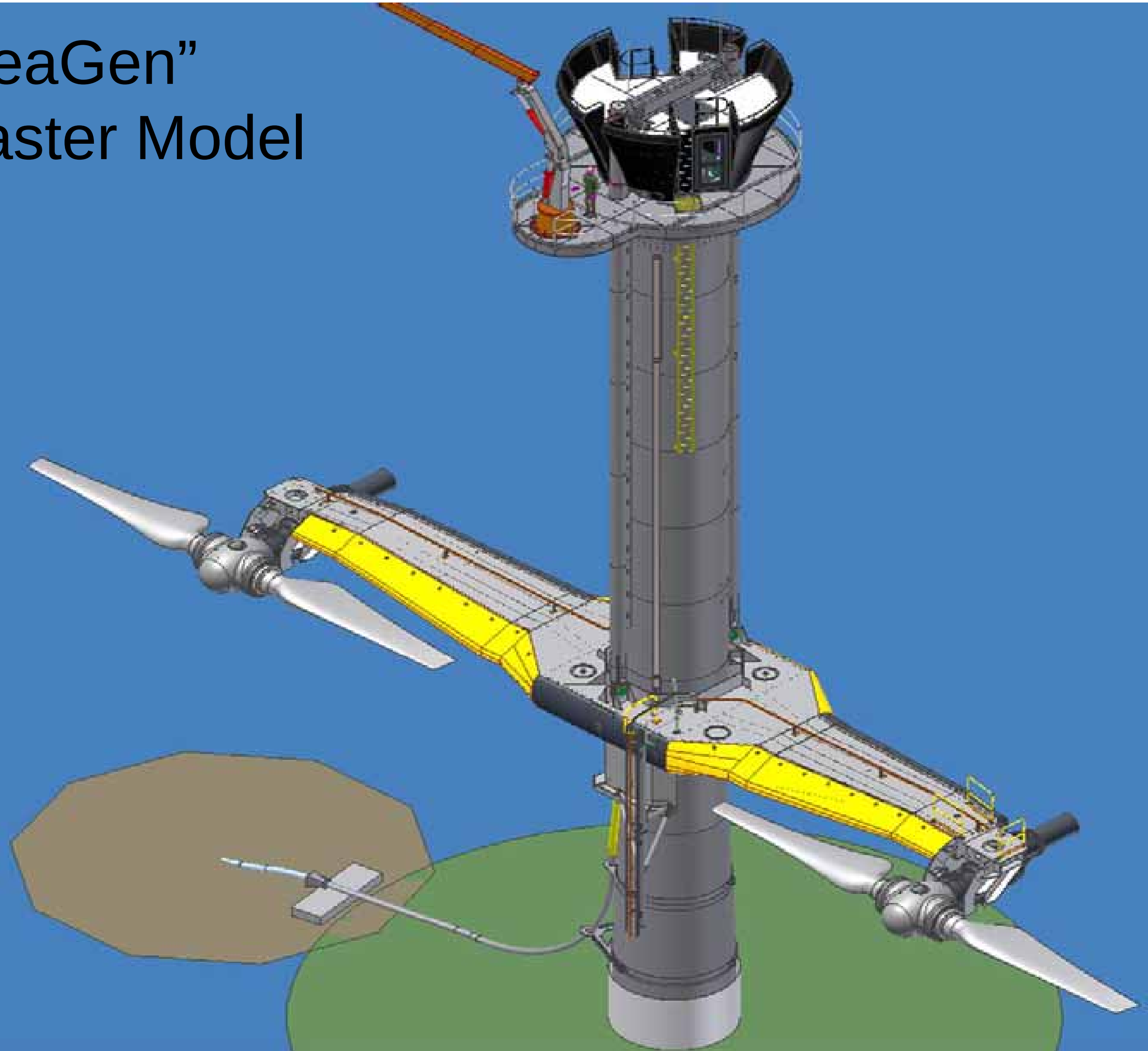
- 2 x 600kW rotors:16m diameter
- installed on steel pile
- rotors and nacelles raised above sea level for maintenance
- transformer and electrical connection to grid in accessible and visible housing at top of pile
- deployment in arrays or “farms”. of hundreds of turbines



SeaGen 1.2MW Commercial Prototype

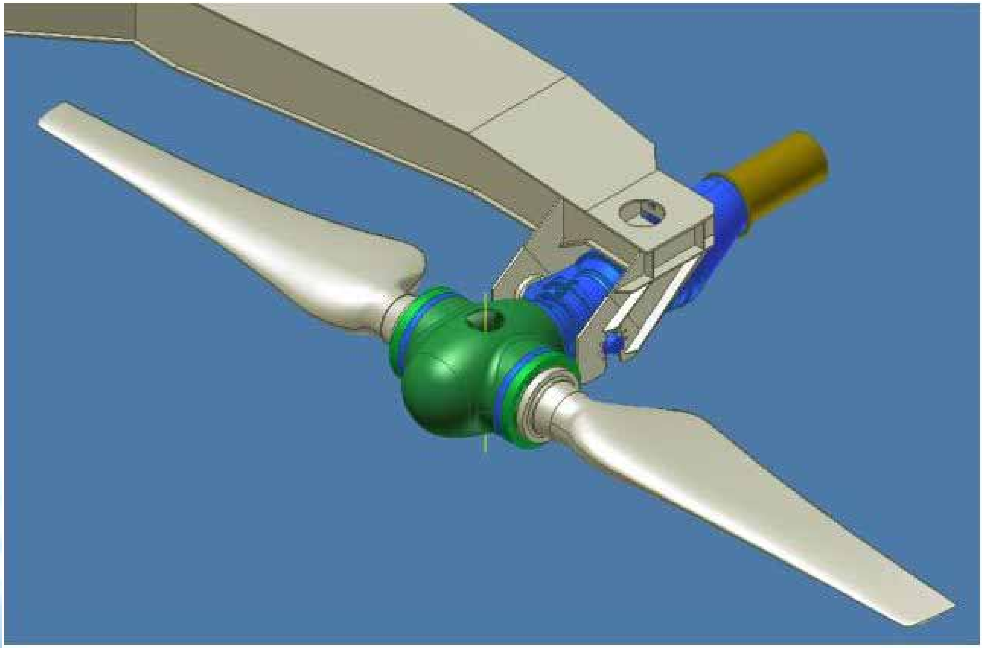
- to be tested in Strangford Narrows, Northern Ireland
- already under construction
- due for installation Dec 2006 or Jan 2007
- will be used as testbed for SeaGen technology
- will have continuous environmental monitoring

“SeaGen” Master Model



Seagen: power trains

- 16m diameter rotors with full span pitch control
- steel and composite cross-arm
- twin 600kVA induction generators



input shaft power: 700 kW
input speed: 12 rpm nominal
design torque: 400 kNm
speed ratio: 1:83

Gearbox, hub and generator under test

Rotor blades - carbon/glass epoxy composite

Testing cross-arm to pile interface

Above surface housing and platform

Black & Veatch due diligence report Comparison of Prototype Costs

Vendor's Due Diligence

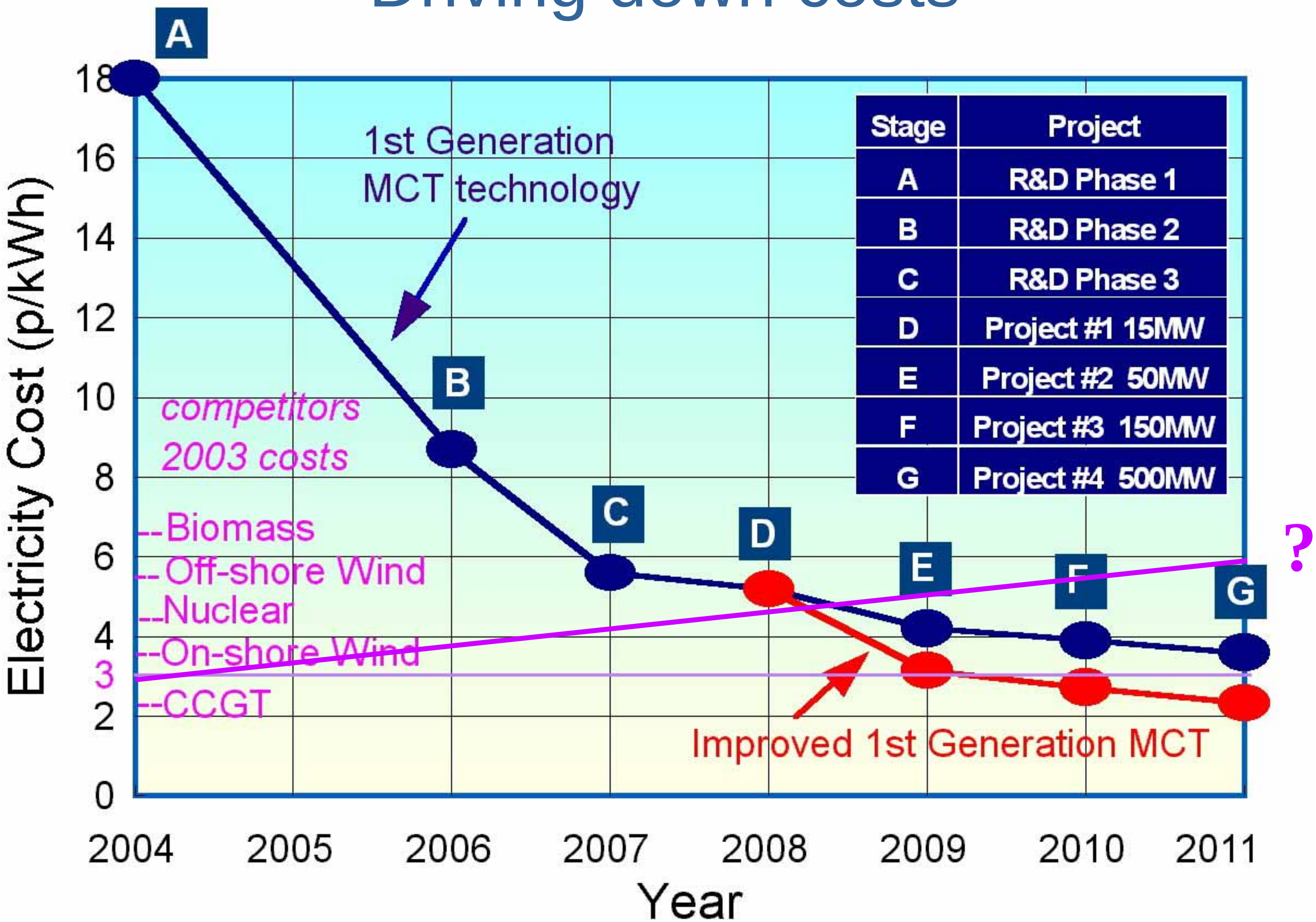
Developer	Device	Rating (kW)	Cost (£m)	Cost/kW (£)
EB	Stingray	150	6.0	40,000
Hammerfest Strom AS	The Blue Concept	300	7.7	26,000
MCT	Seaflow	300	3.5	11,700
MCT	Seagen	1200	6.3	5,250

Table B-4 Comparative Costs of Prototypes

Comparisons:
how many kW per tonne of equipment?

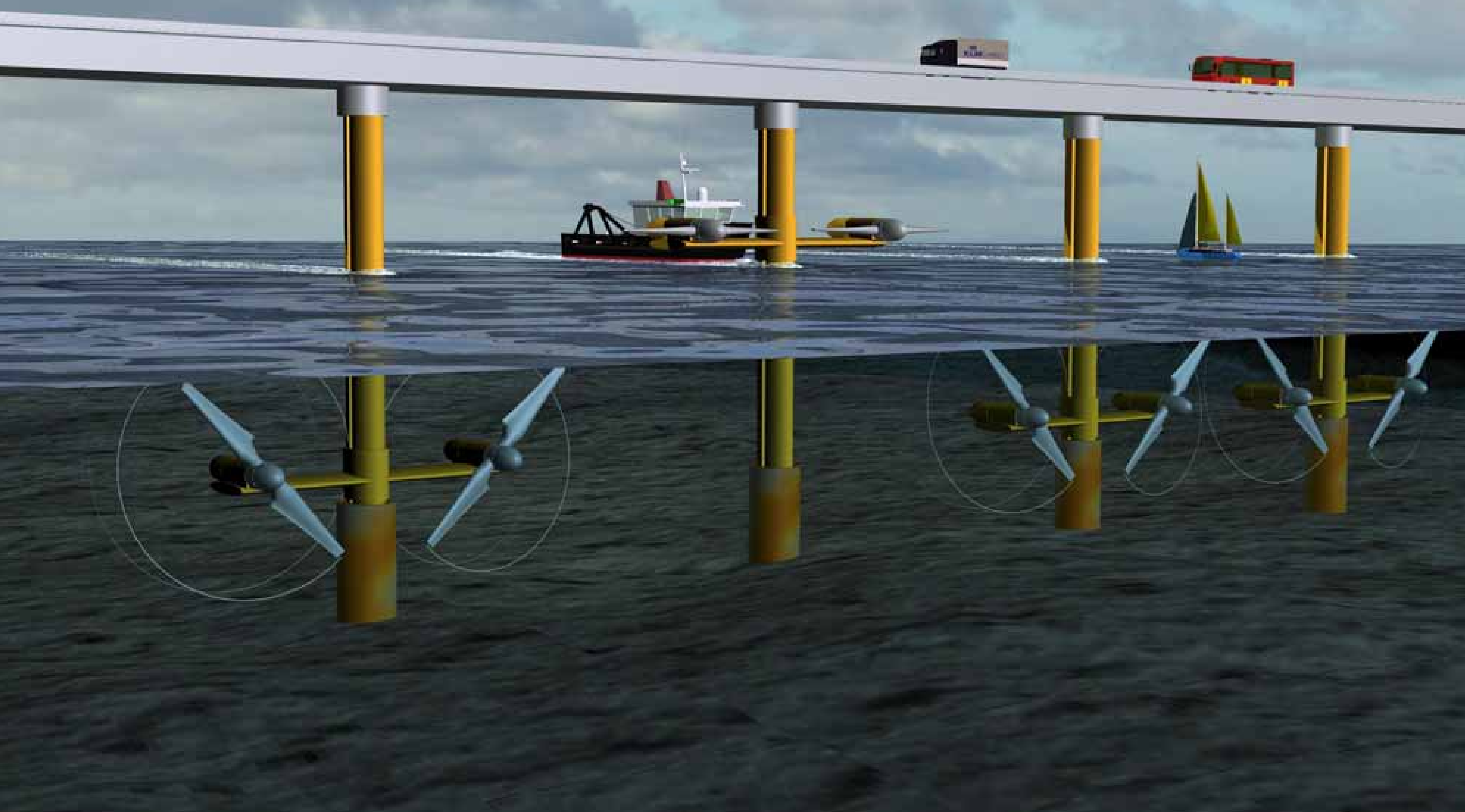
Wave energy devices	< 1.0 kWe per tonne
MCT Seaflow tidal turbine **130t & 300kWe**	~ 2.3 kWe per tonne
MCT Seagen prototype **390t & 1200kWe**	~ 3.1 kWe per tonne
Vestas V80 windturbine offshore at North Hoyle **590t & 2000kWe**	~ 3.4 kWe per tonne

Driving down costs

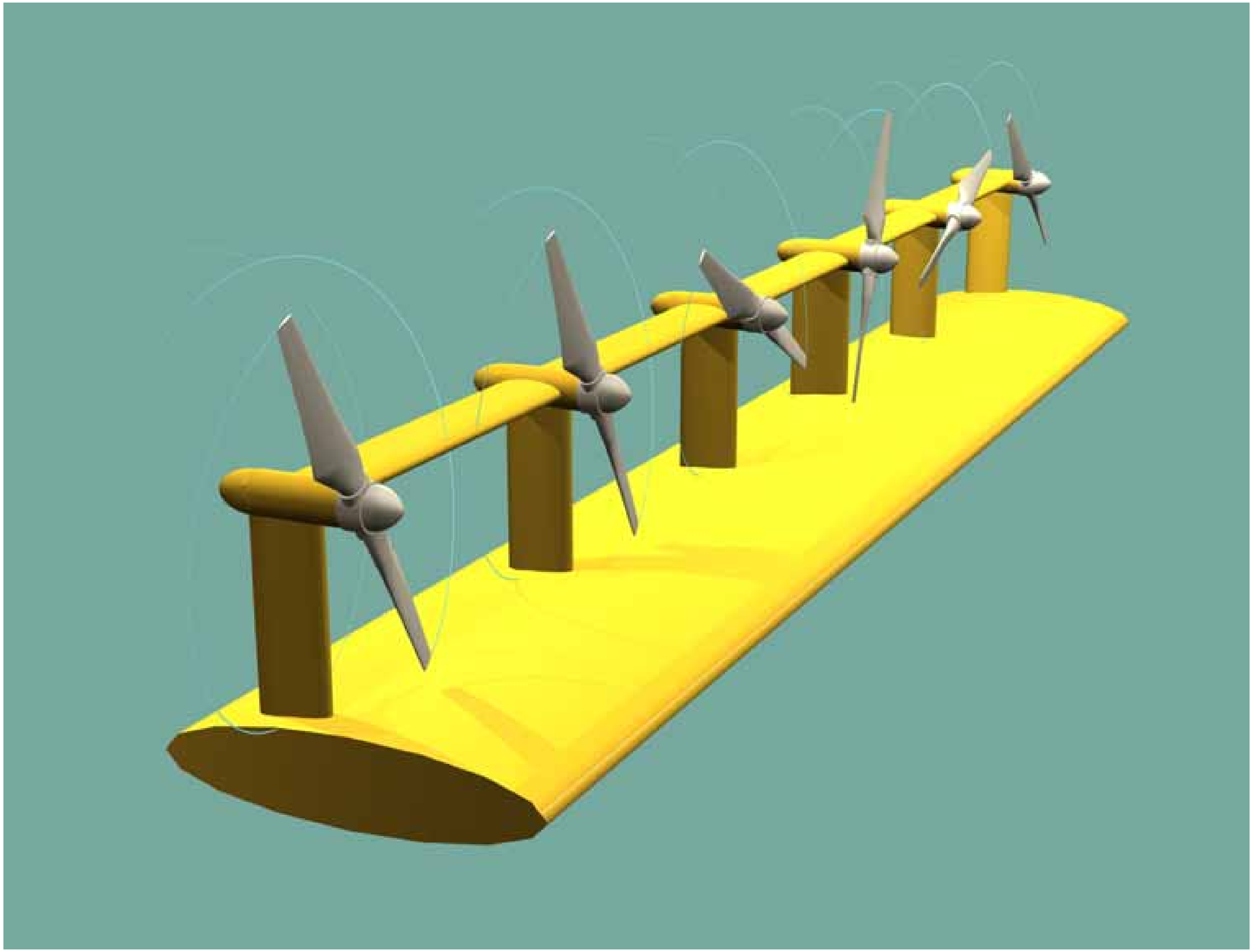


Niche market -

the only tidal stream technology that can carry a bridge deck



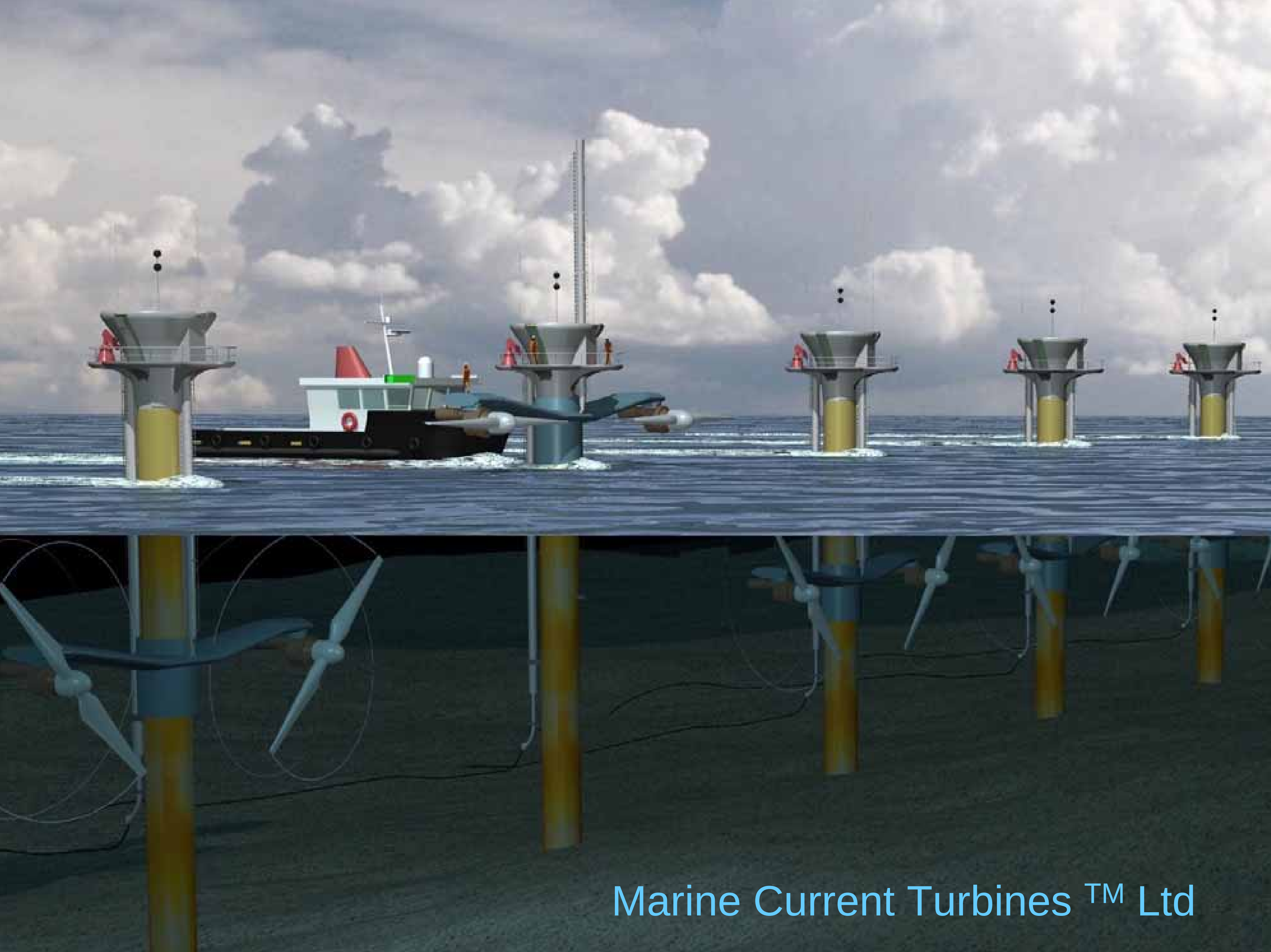
Second Generation - horizontal array structure



In conclusion….

Key advantages of marine current turbines…..

- energy intensity from flowing water is higher than for most other forms of renewable energy
- energy available predictably to a timetable
- energy resource extremely large
- negligible environmental impact (no pollution or noise, no land use, small visual impact);
- major new opportunity for engineering and utility industries
- In short - a new technology whose time has come.


Marine Current Turbines TM Ltd