Accelerating the Commercial Deployment of Marine Energy – Challenges and Opportunities

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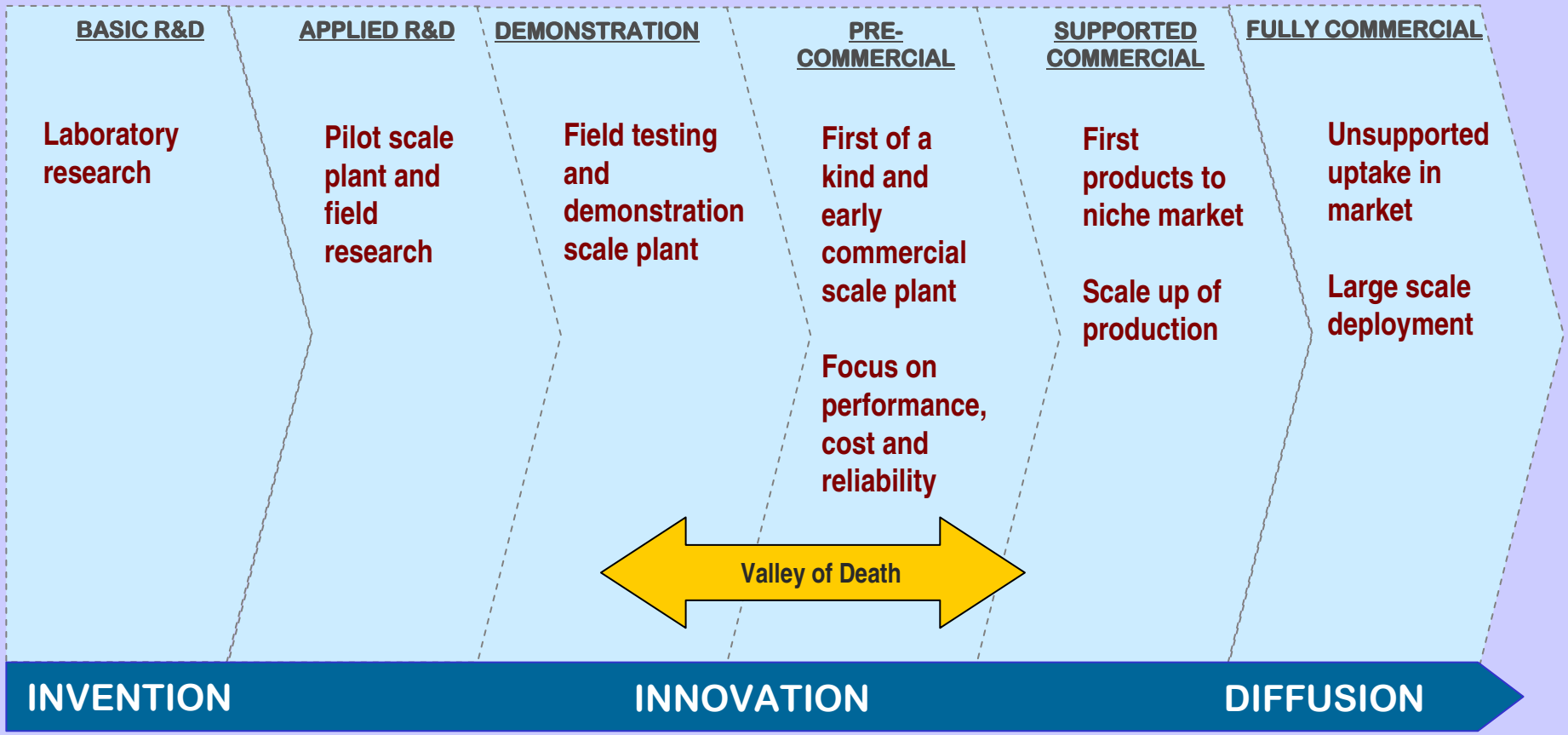
Overview

- Technology innovation
- Marine Energy Context – UK Research Findings
- Barriers and Enabling Policy
- Case Study – Wind Energy in Denmark
- Marine energy in NZ – some issues for consideration

Technology Innovation Process

Technology development is much more than just a product of scientific discovery and market demand……a more sophisticated approach to policy is required



Source: Adapted from Grubb, M., *Submission to Energy White Paper Consultation Process on behalf of the Carbon Trust*, The Carbon Trust, London, 2002; .Foxon, T.J. *Inducing innovation for a low-carbon future: drivers, barriers and policies*, The Carbon Trust, London., 2003

Technology Innovation Process – Some Insights

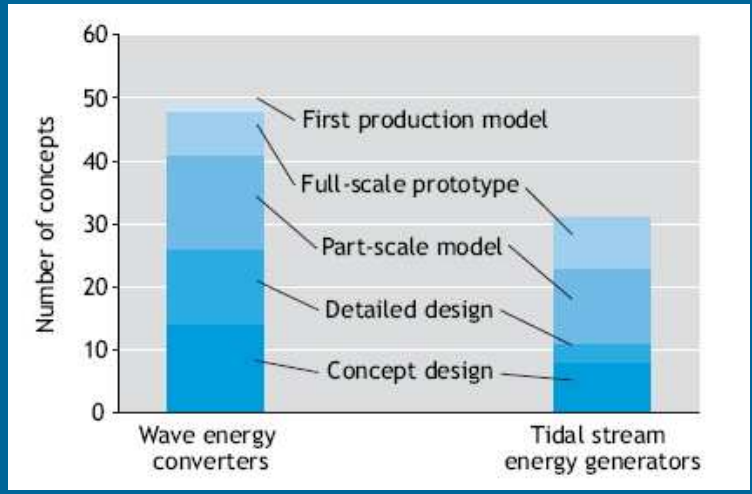
- **Intense interaction and learning within each stage and between each stage**
- **Large number of stakeholders - private businesses, industry associations, national and state governments, universities, research institutions and laboratories, national and international think-tanks, private venture capitalists and entrepreneurs and institutional investors**
- **'Technology push' and 'Market pull' forces play a key role**

Technology Innovation – Marine Energy

The UK Carbon Trust, in conjunction with engineering consultants and universities observed that:

- **There are a wide range of technology approaches for both wave and ocean current energy generation**
- **The majority of technology developers are small teams based in startup companies, specialist equipment manufacturers, university engineering departments or a combination of the three**
- **There are many different design concepts; optimal designs have yet to be established**

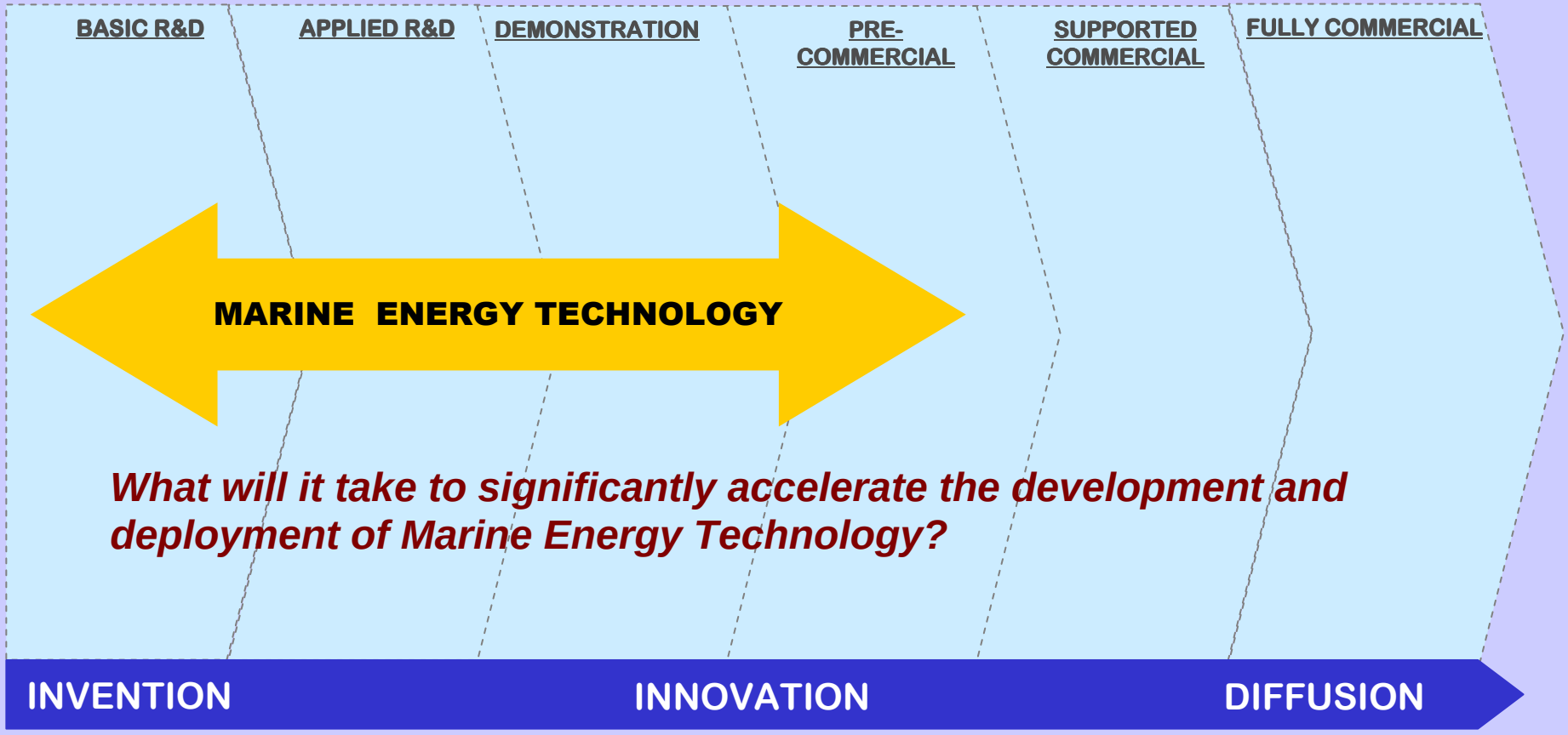
Range of Wave and Ocean Current (Tidal Stream) Concepts under development



Source: UK Carbon Trust, *Future Marine Energy*, 2006

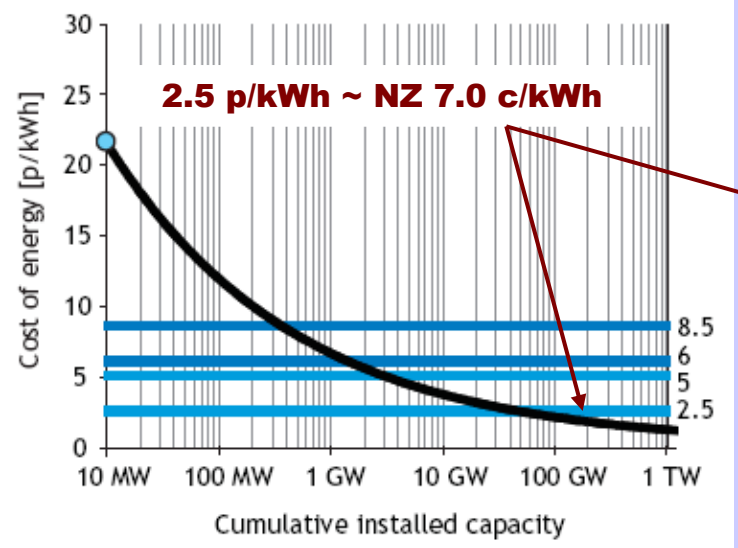
Technology Innovation – Marine Energy (2)

"Overall, wave and tidal stream technology is at a similar stage to wind technology in the 1970s and early 1980s, when a range of wind turbine concepts were being investigated, and it was uncertain which, if any, concept would become cost-competitive" *(UK Carbon Trust)*



Marine Energy Costs – UK Research Findings

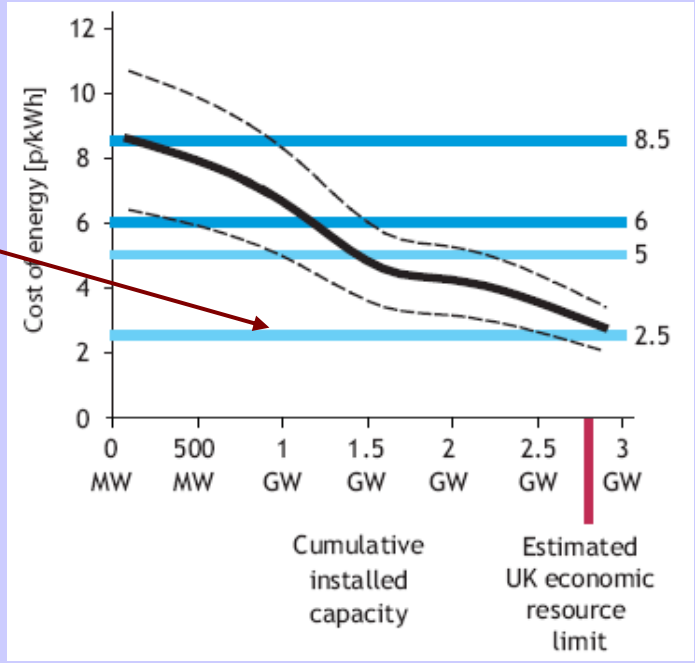
Wave



Optimistic technology development - Application of highest learning rate (15%) to lower bound starting cost

Source: Future Marine Energy – UK, Carbon Trust 2006

Ocean Current

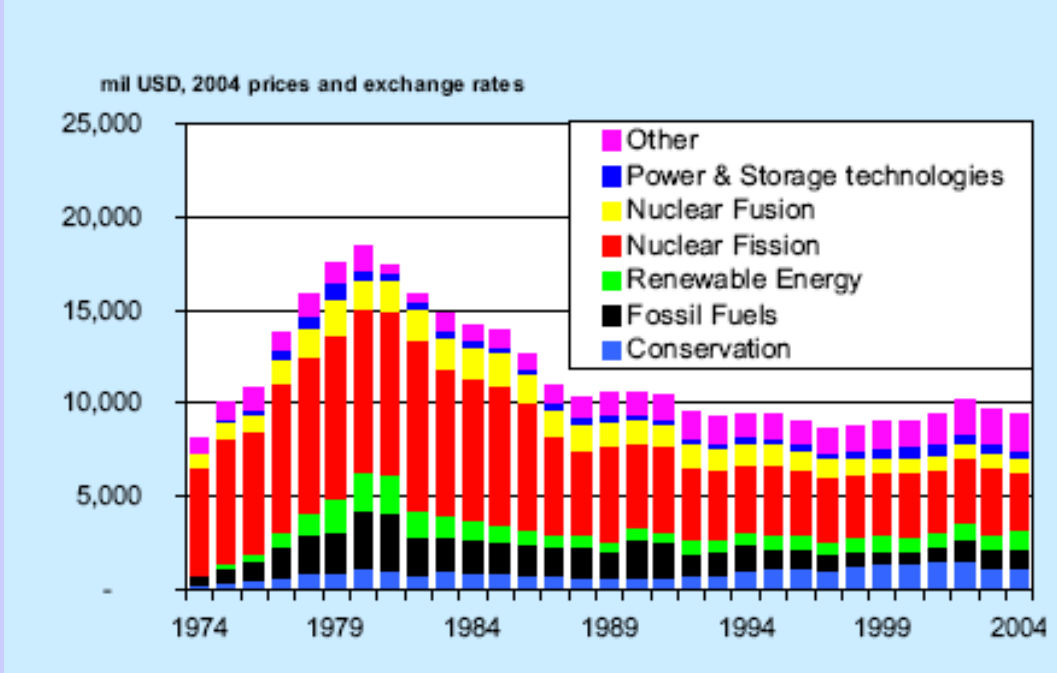


- **Wind Energy parallels: > 12 years to reach 2.5 GW; impact of potential differences in capex/O&M structure and capacity factors**
- **Total cost of support = area bounded by curve and electricity price threshold**
- **Early design improvements and higher electricity price threshold has major impact on total cost of support**

Technology Barriers and Enabling Policy

- **Barriers to Private sector investment in R&D**
  - Strong argument for public R&D support
  - Often addressed by R&D grants and tax incentives
  - The Stern Report => **a doubling of basic R&D, combined with a five fold increase in technology incentives is required**

R&D Spend in IEA Countries – 1974-2004



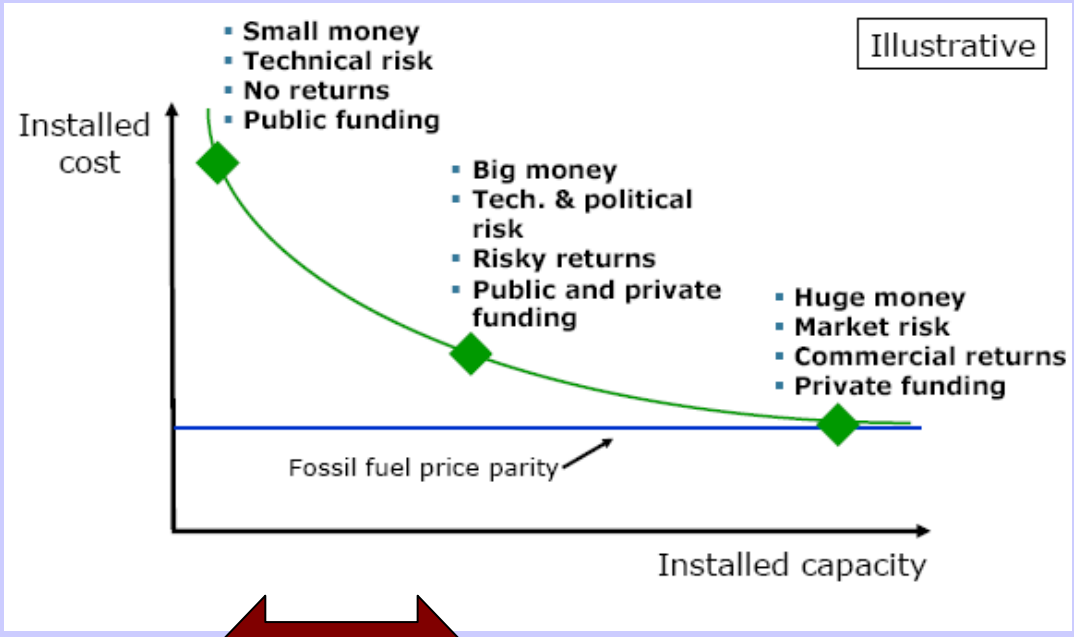
Source: Stern Review – The Economics of Climate Change 2007

Barriers and Enabling Policy (2)

- **Crossing the 'Valley of Death'**
  - Substantial investment is required but significant risk and uncertainty
  - Public R&D cannot drive forward, and demand pull is weak
  - Financing gap cannot be filled by capital markets
  - Innovative policy support mechanisms are required

- **Buying down the learning curve**
  - Requires combination of technology push (R&D support, Public-Private Risk Sharing) and demand pull (Feed in tariffs, RPS)

Technology Evolution and Financing



Indicative positioning of marine energy technology

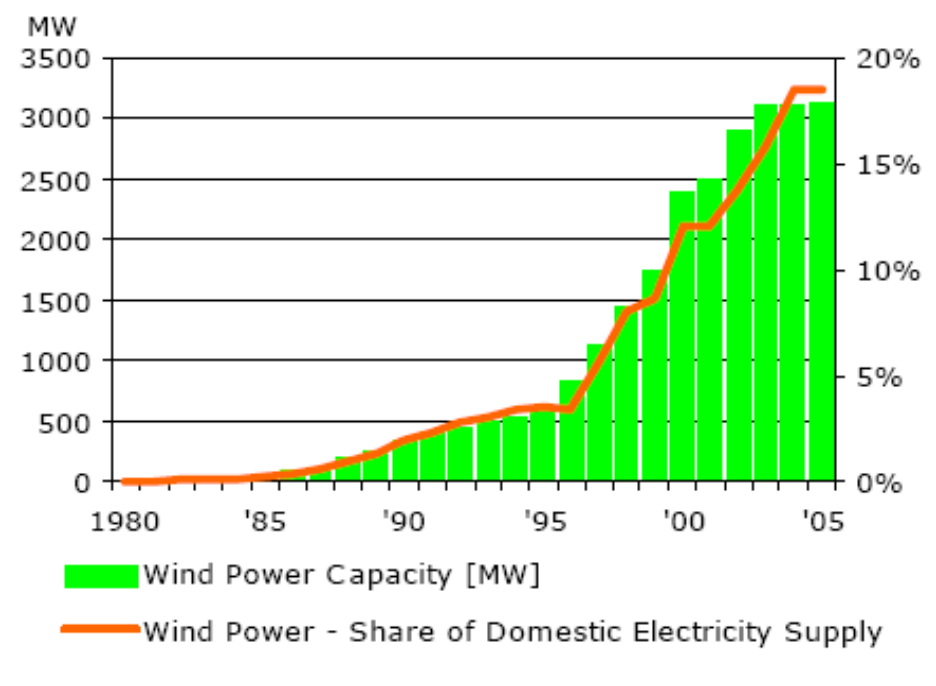
Source: Technology Innovation and Climate Change Policy: an overview of issues and options, Michael Grubb, Keio Journal of Economics (adapted)

Case Study: Wind Energy in Denmark

Nearly 50% of global installed wind energy capacity utilises turbines produced by Danish manufacturers and 90% of output from Danish manufactures is exported

Industry success has been achieved through a finely tuned strategy that has evolved over time to changing industry circumstances

Wind Power - Capacity and Share of Domestic Electricity Supply



Source: Danish Energy Authority - Energy Statistics 2005

Case Study: Wind Energy in Denmark (2)

- **Industry Support Initiatives**
  - Long term energy planning and the commitment to ambitious long term targets
  - Research and development - Consistent and significant investment in fundamental wind energy research since 1976
  - Excellence in wind turbine certification
  - Capital and operating subsidies
  - Mandates to electricity utilities
  - Tax incentives

Ingredients for success

- **Long term policy signals based on long term planning**
- **Range of policy measures that simultaneously addressed players at different points of the value chain**
- **Policy has adapted to changing circumstances**
- **Development of 'technology cluster'**
- **Ensuring the international competitiveness of technology suppliers by not subsidising their activities**

Marine Energy Deployment in New Zealand

- **Accelerating the commercial deployment of Marine Energy requires demand 'pull' policy – which is forthcoming in Europe. In the absence of such policies, commercialisation will be difficult until the technology has moved down the cost curve**
  - The £42m UK Wave and Tidal Stream Energy Demonstration Scheme which forms a key part of the £50m UK Marine Renewables Deployment Fund offers capital grants of up to £5m for any single project plus revenue support at 10p/kWh for 7 years
  - In Portugal, revenue support is available at 23 Eurocents/kWh for projects over 12 years post-commissioning (average industrial electricity price is around 8.2 Eurocents/kWh)

- **What is New Zealand's comparative advantage in this sector, and how can it be leveraged? What role could it play on the global stage?**

- **What role will marine energy play in New Zealand's future energy mix, and over what timeframe?**