# Offshore Renewables

#ETI10

# Welcome and Introduction

Programme Manager – Andrew Scott

# Agenda

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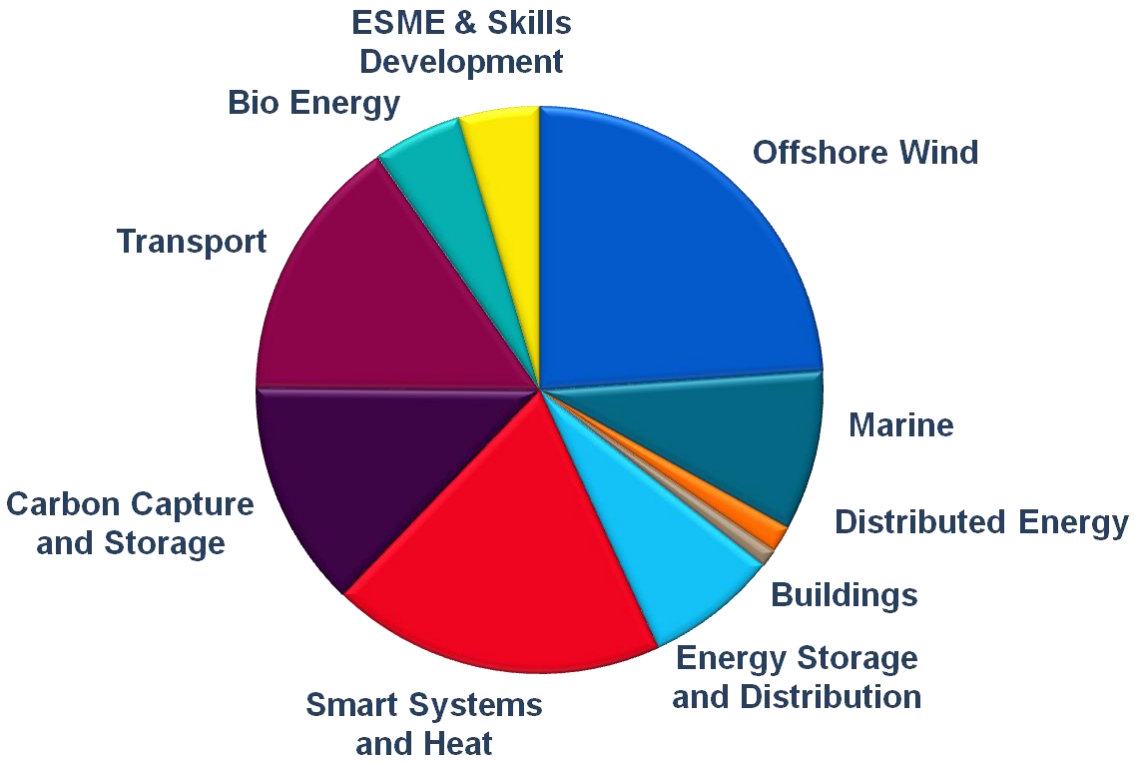
|---|---|
| Introduction | Andrew Scott (ETI) |
| The Offshore Renewables Programme | Andrew Scott (ETI) |
| The ‘Very Long Blades’ Project | Pepe Carnevale (Formerly Blade Dynamics) |
| Pelastar TLP Floating Wind Turbine Foundation | William Hurley (Glosten Associates) |
| UK Offshore Wind Drive Test facility | Tony Quinn (OREC) |
| Marine energy | Henry Jeffrey (The University of Edinburgh) |
| Impact on the energy system from Offshore Wind and Marine | Stuart Bradley (ETI) |
| Close | |

# Introduction to the Offshore Renewables Programme

Programme Manager – Andrew Scott

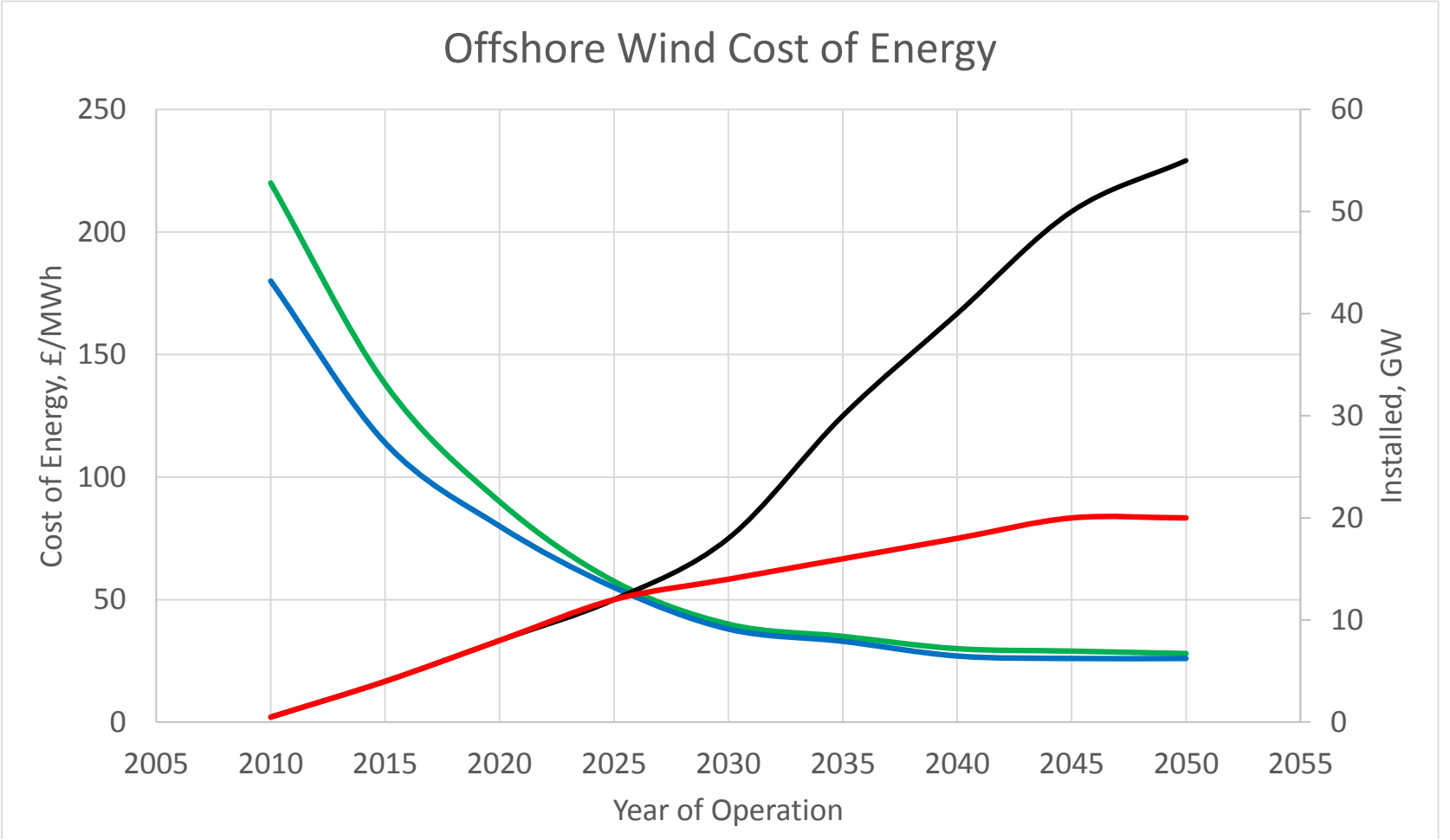
# The ETI has made significant investment in Offshore Wind and Marine Energy Innovation



# Cost reduction was and remains crucial to Offshore Renewables success

- In 2009,
  - OSW costs >£150/MWh
  - Wave > £600/MWh
  - Tidal > £300/MWh
- In 2017,
  - Offshore Wind: £55 - £75/MWh (for most recent CfD round: on line in 2020s)
    - Beating aspiration of £100/MWh by 2020
  - Tidal:  £200 - £300 / MWh; and Atlantis aiming for less, in line with roadmap
  - Wave: £200 - £450 / MWh?
- OSR compete with other forms of low carbon generation, not against each other.
- Cost reductions since 2009 mean that OSW has moved from super sub to opening player, due to cost reduction

# Offshore Wind Deployment 2017 onwards



# WHAT HAVE WE DONE IN OFFSHORE WIND?

# The OSW industry identified key areas for cost reduction

- Bigger, better turbines
- With bigger, more efficient blades
- Installed more cheaply
- With improved, system, cost of energy
- Accessing better wind resource
- Benefitting from volume economics
- With clear returns for stakeholders
- Ability to test new innovation quickly

What are the disruptive technologies going to be?

# The ETI has carried out projects that tackled 4 of these areas

**Bigger Better Turbines**

With higher rated power and higher reliability

**Offshore Wind Drive Train Test Facility at ORE Catapult**
**Condition Monitoring**
**Nova**
**Helm Wind**

**Installed More cheaply**

**Floating Offshore System**

**Bigger, more efficient blades**

**Accelerating deployment of very long blades project**

- modular
- Lighter
- Improved manufacturing, with better tolerances

**Accessing better wind resources (in deeper water)**

**Floating Offshore System**
**Nova**
**Deep Water**

# WHAT HAVE WE LEARNT

# Energy System Scenarios 2017

- **Clockwork**

- 2050 electricity capacity ~ 130GW
  - 43GW Offshore Wind
  - 10GW Onshore Wind
  - 5GW Other renewables

- **Patchwork**

- 2050 electricity capacity ~190GW
  - 55GW Offshore wind
  - 20GW Onshore wind
  - 45GW Other renewables

# Deeper Water Foundation Types




| Cost Drivers | Jacket | HyWind | WindFloat | *PelaStar* |
|---|---|---|---|---|
| Onshore Assembly | ✗ | ✗ | ✓ | ✓ |
| Lightweight Structure | - | ✗ | ✗ | ✓ |
| Turbine Performance | ✓ | ✓ | ✗ | ✓ |
| Siting Flexibility | ✗ | ✗ | ✓ | ✓ |
| Serial Production | ✗ | ✓ | ✓ | ✓ |

*Source: Glosten Associates*

# Offshore Wind Insights Paper, published 2015

- With technology and supply chain development there is a clear and credible trajectory to delivering commercial offshore wind farms
- Floating Wind has the potential to be a cost-effective, secure and safe low-carbon energy source which could deliver a levelised cost of energy of less than £85/MWh from the mid- 2020s
- To deliver improved costs, offshore wind needs access to good quality wind resource close enough to shore and the onshore grid system so that transmission costs are minimised and operations/maintenance costs reduced
- Floating technology can provide access to high quality wind resources relatively close to the UK shoreline and in the proximity of population centres
- In water depths less than 30m fixed foundations will be the prime solution, in water depths over 50m floating foundations provide the lowest cost solution – a mix of these technologies is likely to offer the lowest cost pathway to deliver large scale deployment in the UK

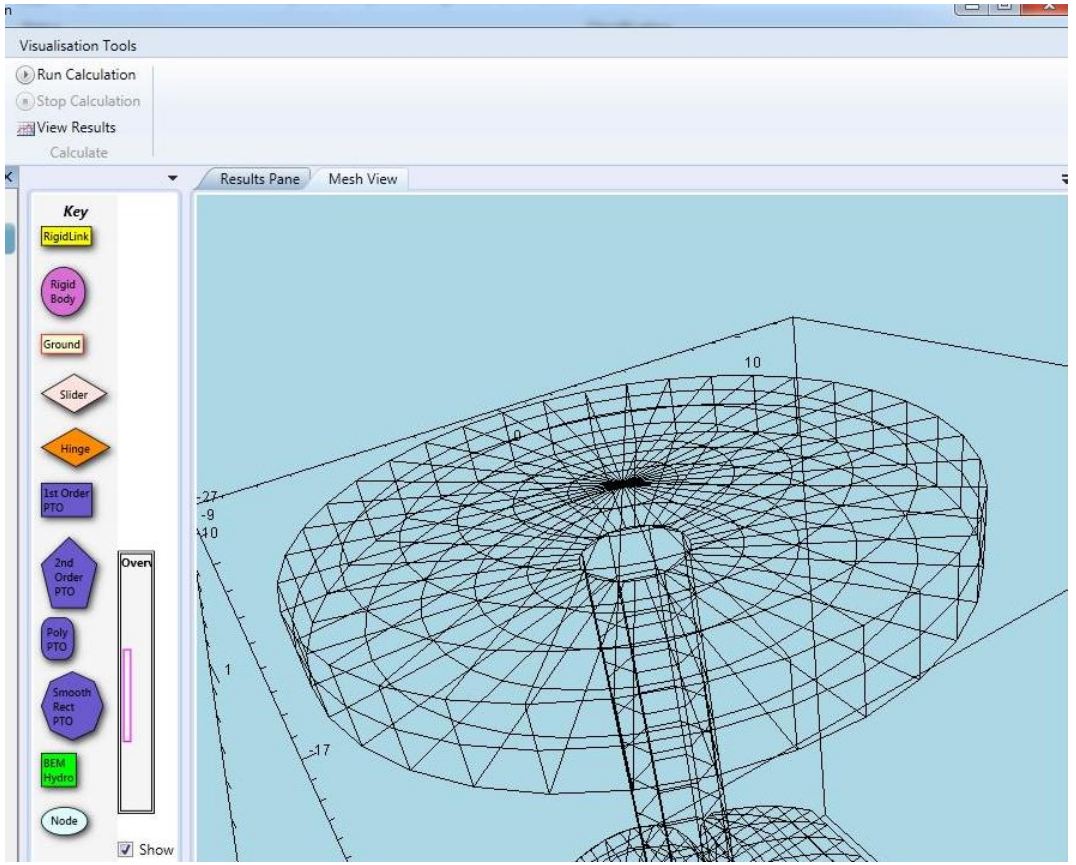
# MARINE; WAVE AND TIDAL ENERGY
# WHAT HAVE WE DONE?

# ReDAPT

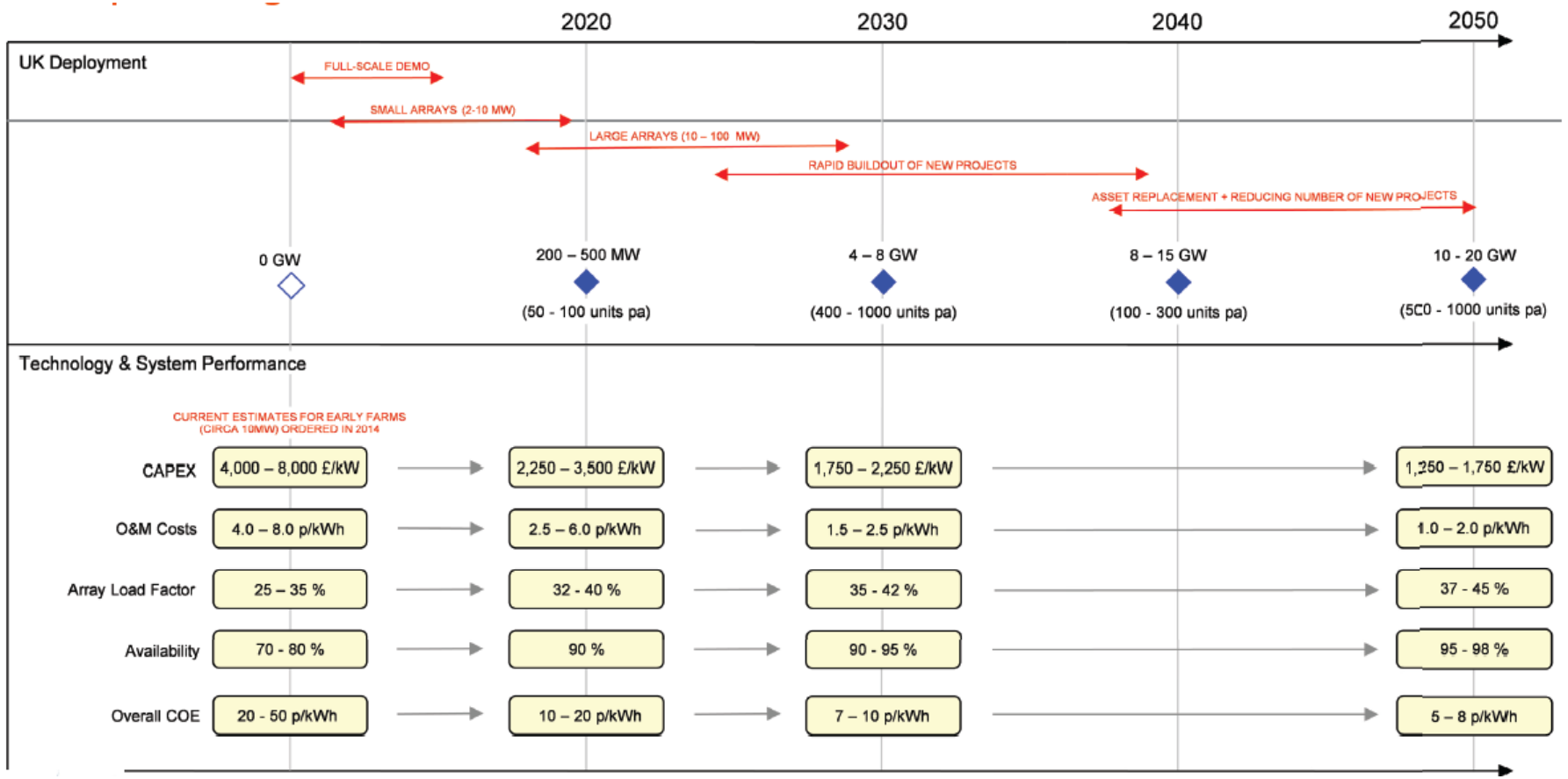
# Wetmate - An 11kV wet connector

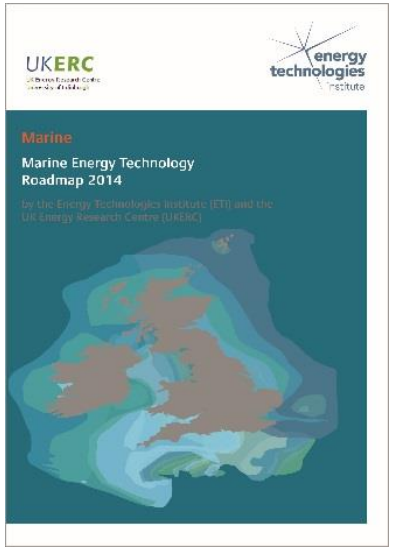
# PerAWaT

- PerAWaT has created commercial products
  - TidalFarmer, WaveFarmer and WaveDyn
  - Smarttide



# Marine Roadmap: issued April 2014



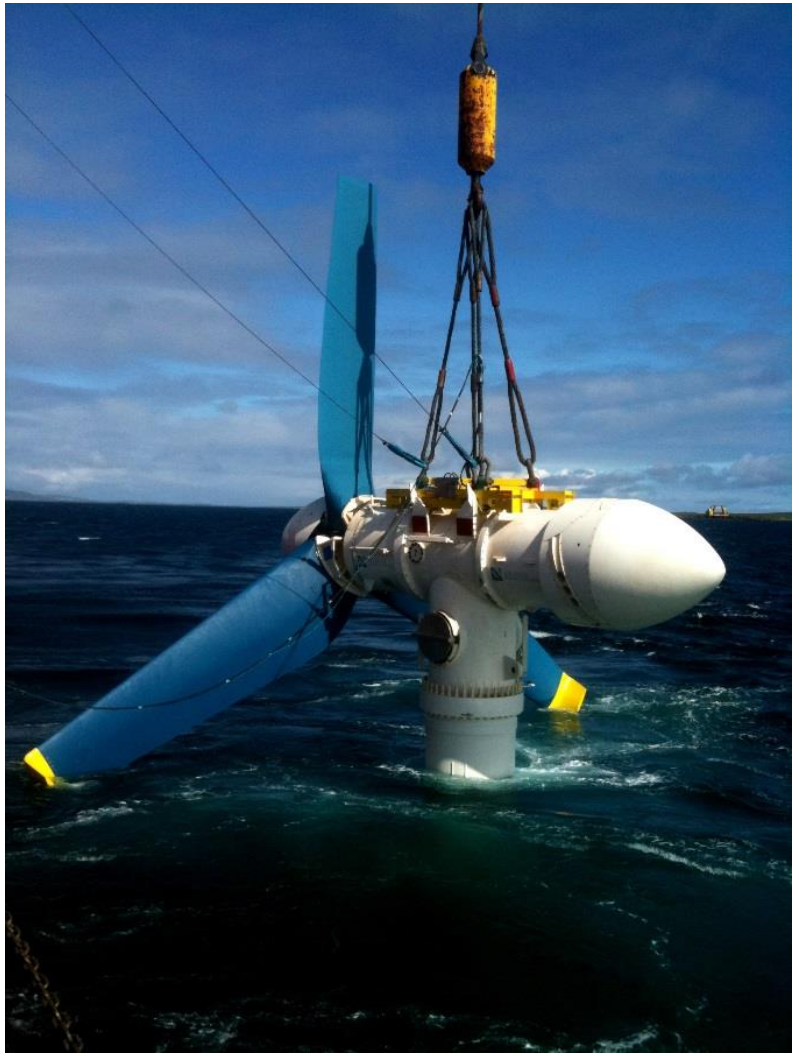



# WEC

- Provided insights into the impact of innovation on capex, opex, and energy yield
- Pathways to significant LCOE reduction have been identified
- But none of these pathways is aggressive enough to deliver the LCOE targets in line with Roadmap timescales
  - 2020 targets not achievable until around 2030 – too late??
- This in itself is an extremely valuable insight

# TEC

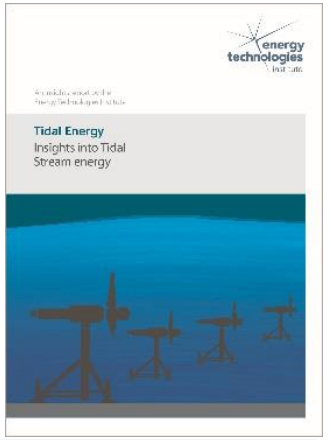
- Took a genuine array level approach
- Showed that the Roadmap targets are achievable with targeted innovation investment



# WHAT HAVE WE LEARNT?

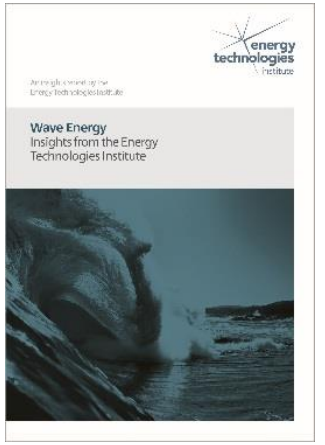
# Tidal Energy Insights, published 2015

- There is a demonstrable route to making tidal stream energy competitive with other low carbon technologies; tidal stream has the potential to be a material part of the future UK energy system
- Tidal energy is capable of supplying 20-100TWh of the 350TWh of the UK's annual electricity demand
- Potential impact of the tidal industry on UK GDP is estimated to be in the range of £1.4 - 4.3billion
- The cost of energy from tidal stream arrays can compete with other low-carbon sources
- The sector has transitioned in recent years from small-scale prototype devices, through to full-scale demonstration and early commercial arrays are now in development
- The UK leads the rest of the world in the development of tidal devices
- Significant cost reduction will require coordinated investment in supply chain innovation, processes and people.
- Array and device design integration is vital



# Wave Energy Insights, Published 2015

- The UK has some of the world's best available tidal and wave resources
- Even with aggressive cost reduction and innovation activities current attenuator wave energy technologies are unlikely to make a significant contribution to the UK energy system in the coming decades
- Radical new wave energy extraction and conversion system approaches are needed to reduce cost and increase energy extraction and reliability. This will provide a trajectory towards lower cost solutions in the long term



# In Summary

- Offshore Wind is both a main player and the main energy hedging options for UK 2050
  - Technology Innovation has and will continue to significantly reduce energy cost
- Tidal could have a role in the future UK energy mix in 2050
- Wave Energy is further behind
- The ETI Programme focused on accelerating innovation and cost reduction
  - Supported by in depth technical due diligence
  - Leveraging a wide range of expertise