



Scottish Renewables Marine Energy Conference

the next steps





*Scottish Renewables Marine Energy Conference
the next steps*

finance - getting on the curve





Finance – ‘Getting on the Curve’

Simon Grey

Chief Executive, AWS Ocean Energy



RAB CAPITAL

TUDOR

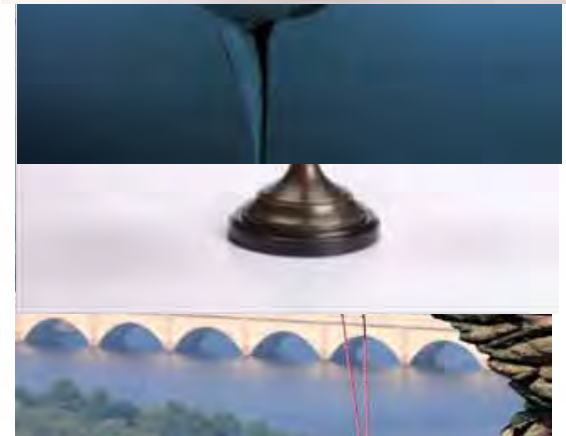
Risk



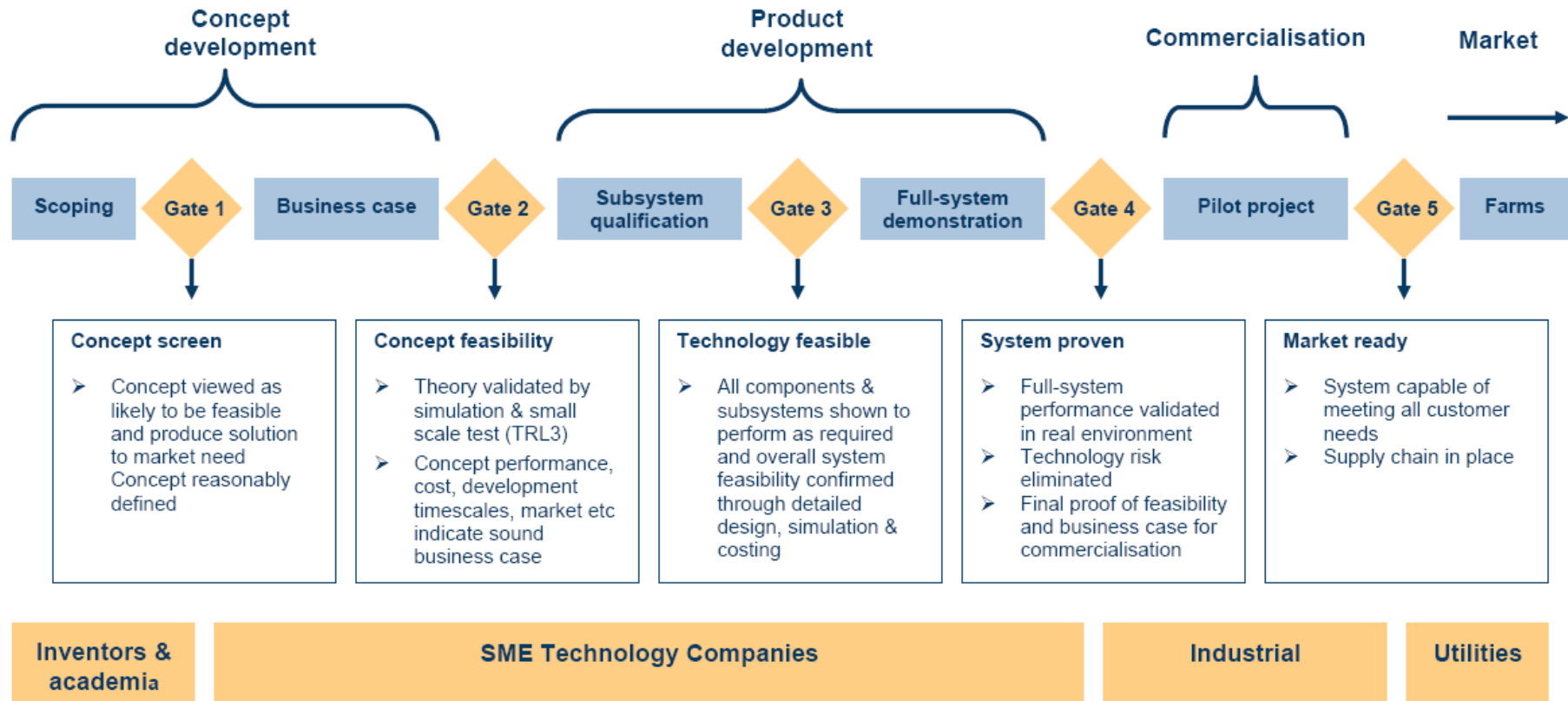
Financing - vital ingredients



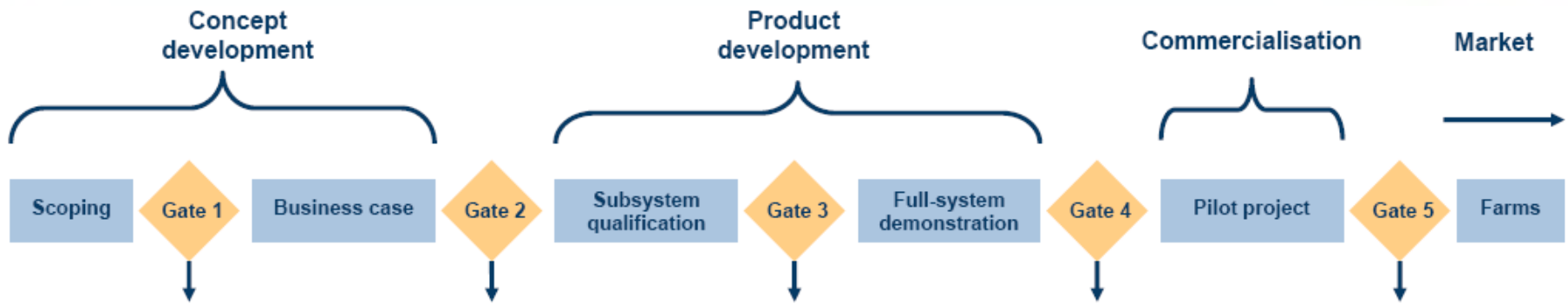
- Technology
 - Must provide a genuine, compelling proposition
 - Meet market needs better than alternatives
- Integrated business, IP and technology development strategy
 - Know your place in the food-chain
 - Use the right money at the right time
 - Place risk with those best placed to understand and manage it
- Team and rigorous processes to ensure delivery
- Focus on shareholder value and stakeholder returns



Development life-cycle



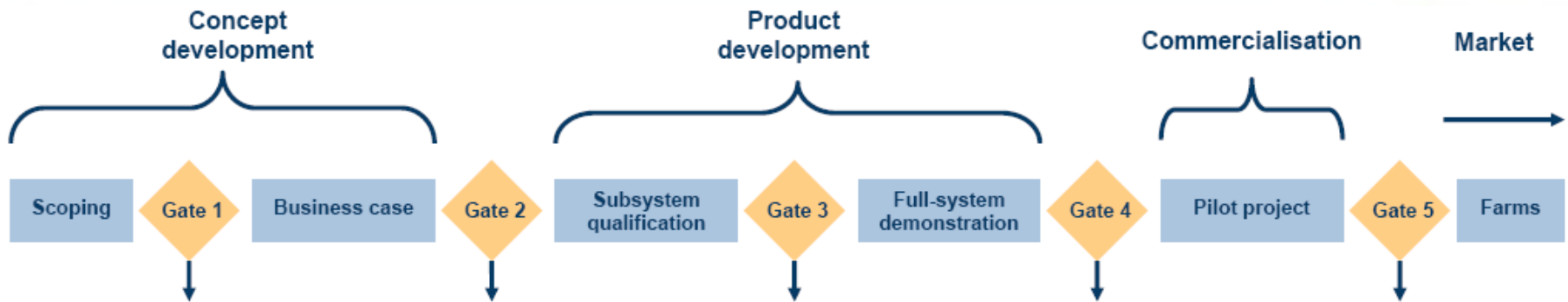
Development life-cycle – Gate 1



Gate 1 Criteria - *Is the idea worth taking forward?*

- Technical (TRL 1 - 2)
 - Is the fundamental physics right?
 - Are the key assumptions reasonable?
 - Are there hidden flaws?
- Commercial
 - Can it meet a genuine market need – who will buy and why?
 - Is there a chance it can be economically attractive
- Follow-on
 - Can the technical challenges be met?
 - Can the development plan be resourced and financed?
 - Do you have a detailed, workable plan for getting through Gate 2?

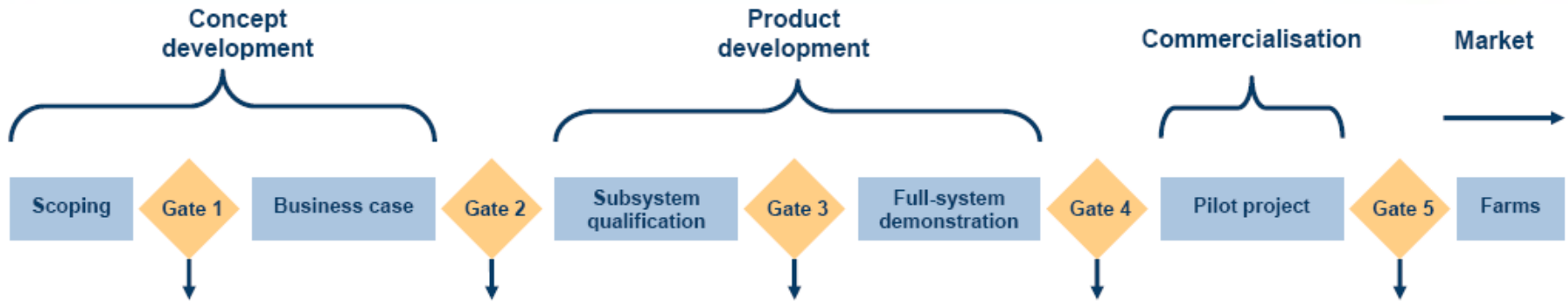
Development life-cycle – Gate 2



Gate 2 Criteria - *Is the idea still worth taking forward?*

- Technical (TRL 2)
 - Are the fundamental physics and key assumptions validated by test / & modelling?
 - Is there an outline design which includes ALL system elements?
 - Are there hidden flaws after diligent review?
- Commercial
 - Can it meet a genuine market need – who will buy and why?
 - Is there a chance it can be economically attractive – based on costed design and validated models?
- Follow-on
 - Can the technical challenges be met and what is the detailed plan for addressing these?
 - Can the development plan be resourced and financed?
 - Do you have a detailed, workable plan for getting through Gate 3?

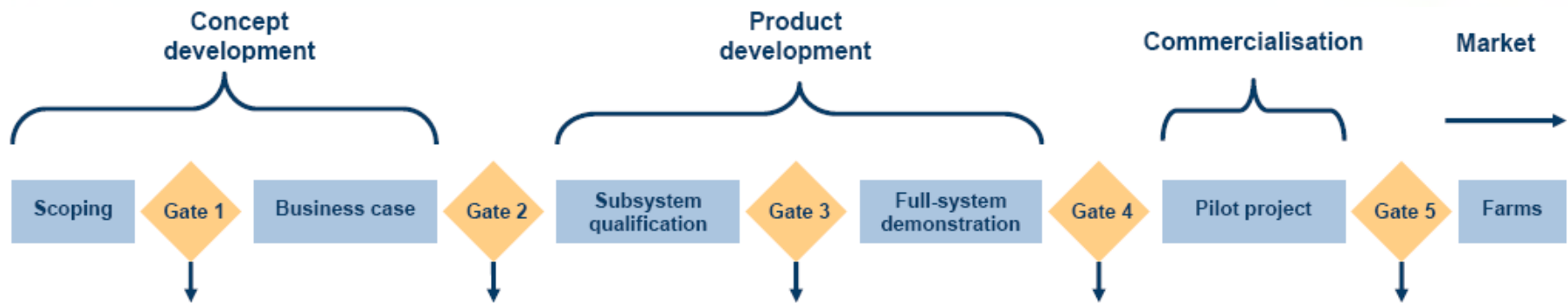
Development life-cycle – Gate 3



Gate 3 Criteria - *Is the idea still worth taking forward?*

- Technical (TRL 4 - 5)
 - Are the fundamental physics and key assumptions validated by extensive test / & modelling?
 - Are all components and subsystems qualified (validated in lab and/or real world)
 - Is there a design for a full-system prototype which includes ALL system elements?
 - Are there new or technical risks emerging?
- Commercial
 - Is the commercial case still on-track and supported by the technical results and detailed costings?
 - Is this confirmed through dialogue with partners and end-customers?
- Follow-on
 - Can the technical challenges be met and what is the detailed plan for addressing these?
 - Can the development plan be resourced and financed?
 - Do you have a detailed, workable plan for getting through Gate 4 agreed with partners?

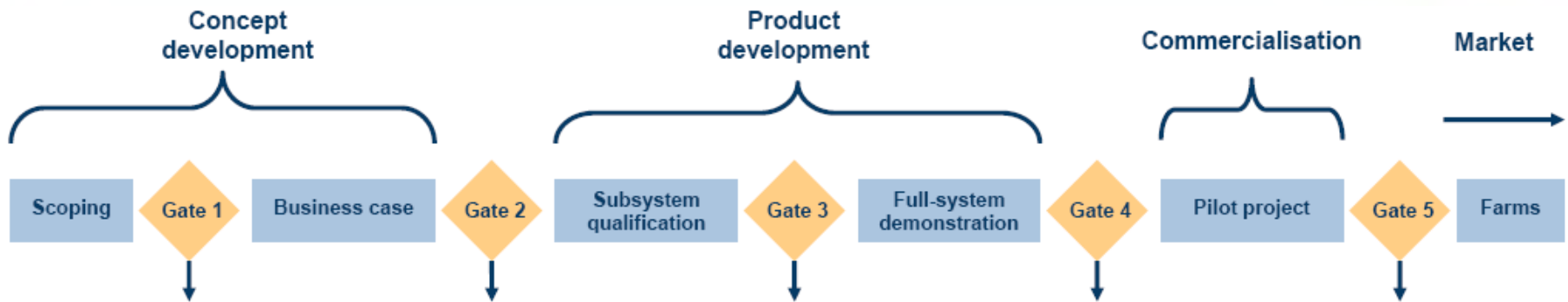
Development life-cycle – Gate 4



Gate 4 Criteria – *Will a large industrial company invest in commercialising this technology?*

- Technical (TRL 6 - 7)
 - Has the full system been qualified and technology risk removed through test?
 - Is there a design for the commercial system which includes ALL system elements?
 - Are there any un-met technical risks which a partner will not be comfortable with?
- Commercial
 - Is the commercial case still on-track and supported by the technical results and detailed costings?
 - Do you have a confirmed licensing / commercialisation deal?
 - Do you (and your partner) have provisional orders from end-users?
- Follow-on
 - Will the remaining demonstration activities deliver a market-ready product?
 - What are the remaining challenges and what is the plan to address these?

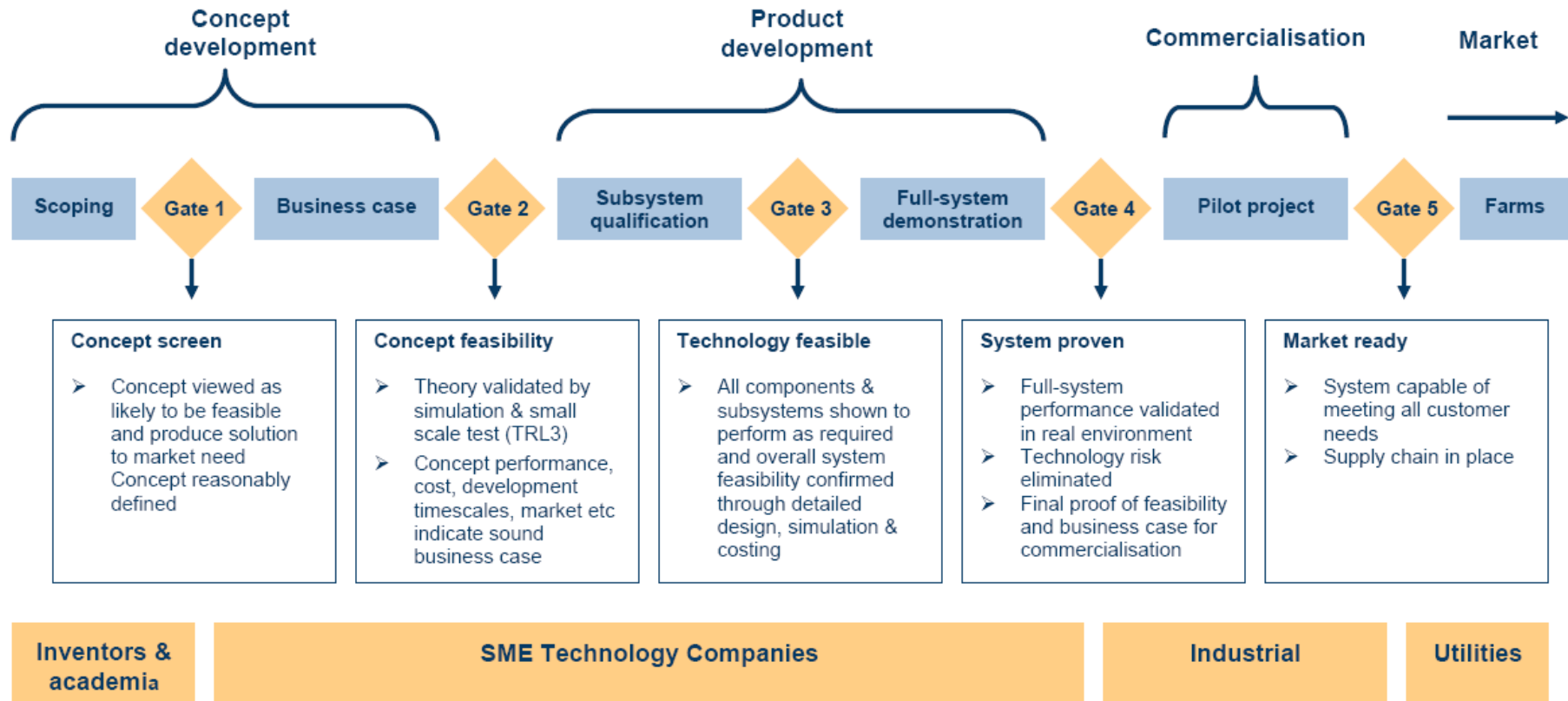
Development life-cycle – Gate 5



Gate 5 Criteria – *Will a utility customer build power-stations using this technology?*

- Technical (TRL 8)
 - Has technical uncertainty been reduced sufficiently to enable warranties to be provided?
- Commercial
 - Does deployment of the technology provide adequate returns for customers at First Farm scale?
 - Are there other advantages to the technology which will result in it being preferred to competitor solutions?
- Follow-on
 - Is adoption of this technology a sustainable proposition for the end-user?

MEG Roadmap?



- We need a joined-up framework that covers all the stages and is stable for the long-term!

To sum up

- AWS has faced up to the tough realities of delivering wave energy technology
- It is our financing and risk management strategy that has kept us alive
 - We may be taking longer, but we have avoided further unnecessary and expensive mistakes
- Our continued success in fund-raising confirms that we have a compelling proposition
- And back to the technology update . . .





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Overview of UK Government's Marine Energy Policy

Setting the context for developing marine energy in the UK

Alan Morgan

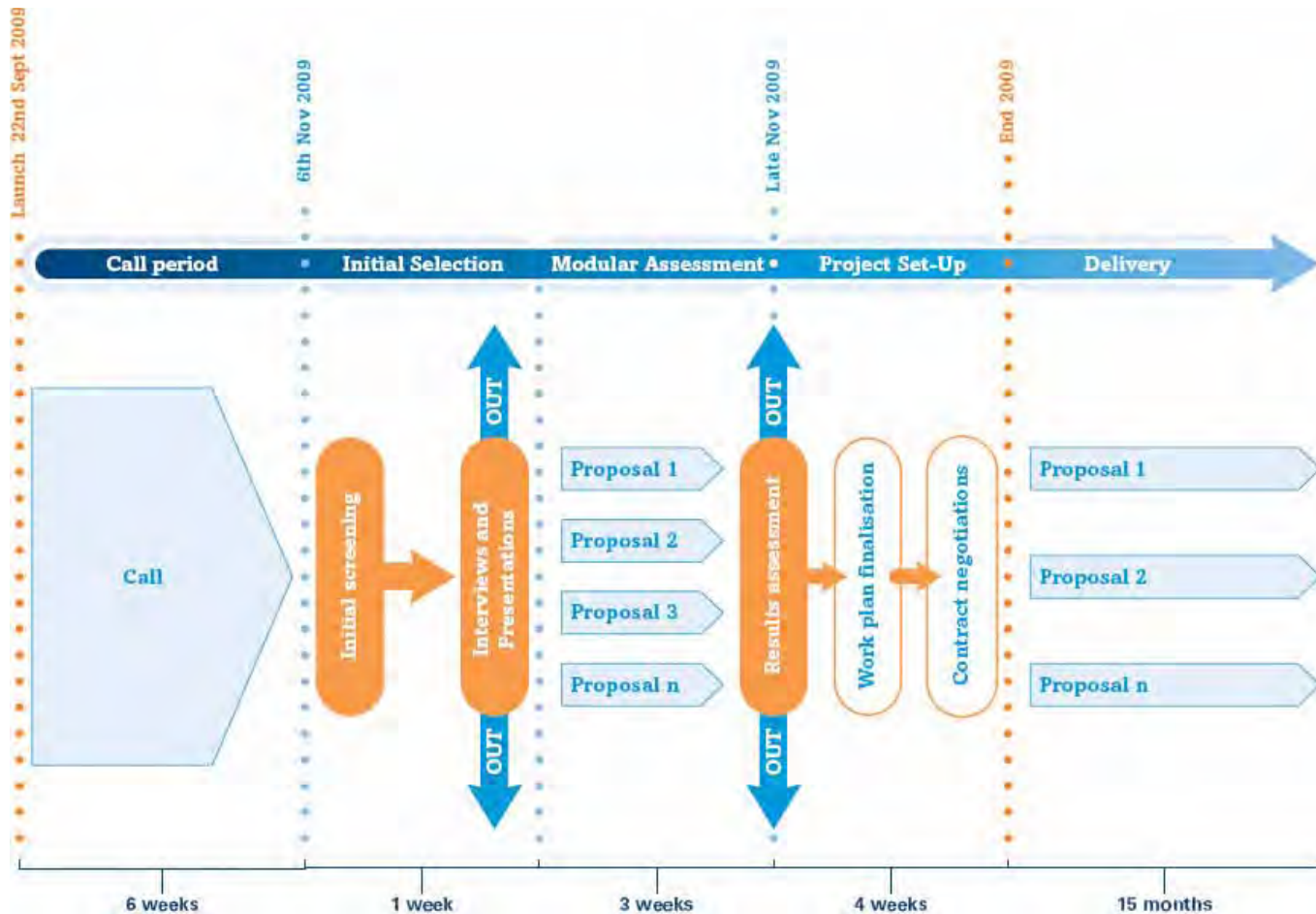
Wave and Tidal Unit

DECC

- Suite of marine energy announcements in the Renewable Energy Strategy – July 2009
 - £10m to NaREC to develop onshore wave and tidal testing facility
 - £8m to expand facilities at EMEC
 - £9.51m to support Wave Hub
 - £22m for a “Marine Renewables Proving Fund” to be administered by Carbon Trust
 - Evidence gathering on marine RO banding
 - Retention and extension of the MRDF
 - £10m of additional investment in the South West

Marine Renewables Proving Fund

Proving Fund is currently on Track. Carbon Trust is currently assessing applications to shortlist interview candidates



- *Applications closed noon Friday 6th November.*
- *CT received 31 applications (19 wave 12 tidal) totalling £202m, of which £88m is requested as grant funding.*
- *10 applications from Scotland.*
- *Currently undertaking the initial assessment, which will determine which are invited for interview.*
- Interviews staged on November 16, 17 and possibly 18th November.
- Best projects then go forward straight away to full due diligence (3 weeks).
- Intend to sign up the first projects this calendar year.

- *“This will consider the prospects and environmental implications of wave and tidal technology, including any planning and other barriers to development, along with the nature of support needed to facilitate effective deployment. The Action Plan will provide a basis for considering the framework of support for the deployment of wave and tidal stream technologies going forward.”*

Para 5.28 - The UK Renewable Energy Strategy, Cm 7686.

Action Plan Terms of Reference



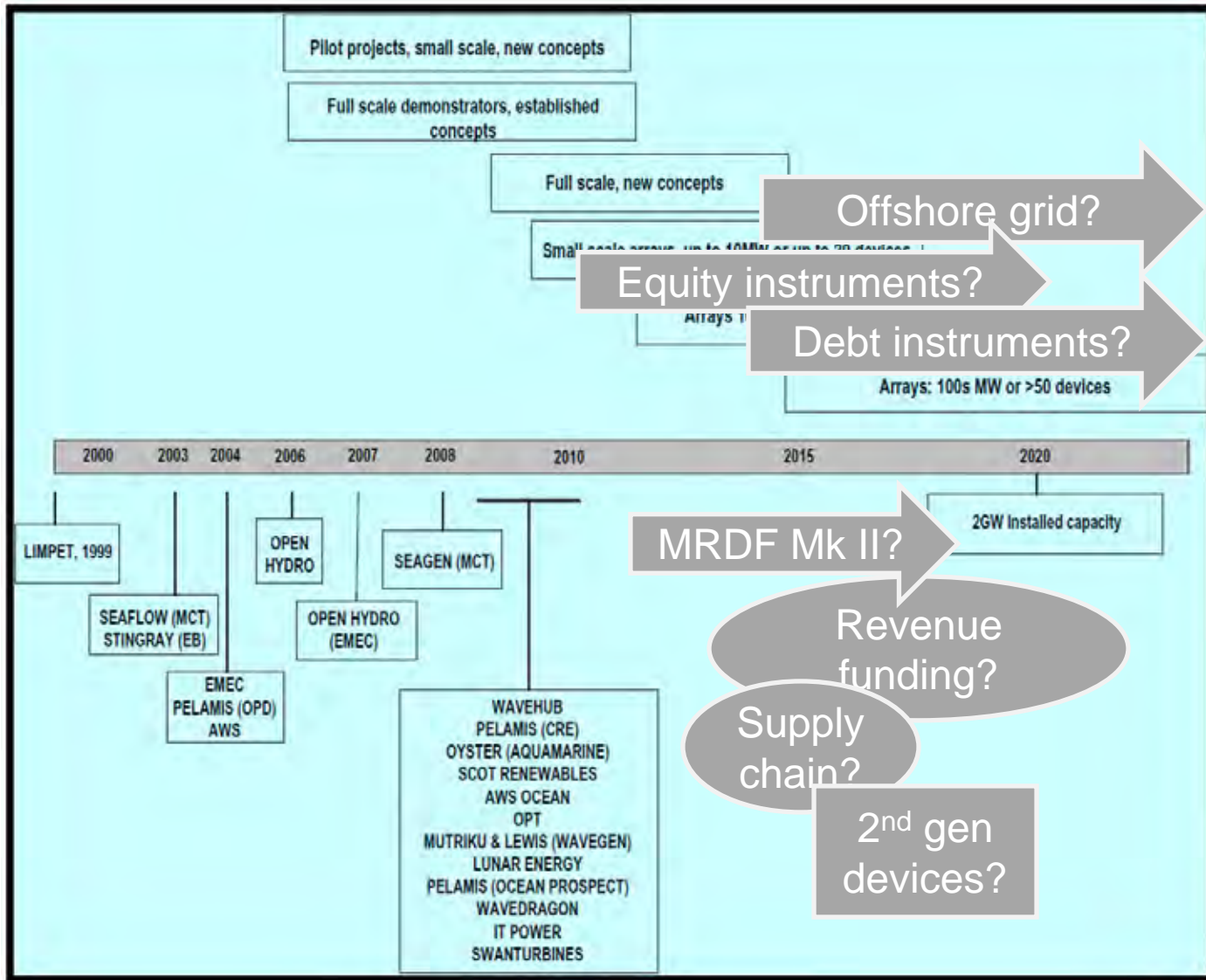
- Developed by DECC with the private sector
- Will set out a vision to 2030 (with ref to 2020)
- Outline actions required by **both** private and public sectors to facilitate the development and deployment of marine energy technology
- Covers wave, tidal range and tidal stream energy (outside the Severn)
- UK-wide focus (while taking account of devolution)
- Plan to publish Spring 2010
- Practical, working document which will be subject to revision over time

- Five work streams:
 - Financing and Funding of the Sector
 - Marine Technology Road Mapping
 - Infrastructure (including supply chain/skills and physical infrastructure – incl grid, ports etc)
 - Planning, consenting, licensing and environmental issues
 - Business/commercial structures
- Working groups will work in parallel to produce recommendations

- **Financing and funding of the sector:**
 - The funding landscape
 - Leveraging private capital into the sector
 - Funding Projects (at demonstration and deployment phases)
 - Revenue support for wave & tidal technologies: in particular through the Renewables Obligation
 - Is there a stronger role for Government Investment or other intervention models?

- **Marine technology roadmap:**
 - Build on existing UKERC technology roadmap with input other similar work
 - Update forecast of multi-device array & commercial deployment in UK waters
 - Cost reduction through technology development
- Form a time-line/framework for the Action Plan

Technology Road Mapping



- **Developing infrastructure:**
 - **Supply chain and skills:** development of UK-based skills and supply chain, e.g.
 - Installation & maintenance vessels
 - Manufacturing facilities/ consultancy services
 - Skills, training and leveraging in expertise from other/related sectors
 - **Physical Infrastructure:** timely availability physical infrastructure, e.g.
 - Ports/harbours
 - Grid
 - Other – Manufacturing facilities / transport logistics etc

- **Planning, consenting & environmental issues:** will include topics such as
 - Onshore and offshore planning
 - Strategic Environmental Assessments and other environmental monitoring requirements
 - Licensing and consenting
- Likely to draw in conclusions of work being carried out elsewhere in the public sector

- **Business/commercial structures:** output may be less tangible than other work streams
 - will cover a range of broader, sector-wide issues, e.g.
 - Encouraging cross-sector work on resource and other generic information
 - Technological and commercial consolidation of the sector
 - Business models
 - Other issues?

Timeline...

- First meeting of the Action Plan Steering Group – chaired by Lord Hunt on 23 Sept 2009
- First work stream meetings have taken place
- Development of work stream conclusions by February 2010
- Compilation of final report Feb/March 2010
- Action Plan published for consultation – end March 2010
- ...ongoing revisions over time...

Changes to the RO - Consultation



- Over 750 responses received to the Renewable Electricity Financial Incentives consultation (Both FITs and RO)
- Government response to the consultation due in mid December

RO emerging comments

- Respondents calling for an extension of the life-time of the RO to 2040
- A majority of respondents agreed that projects commissioned before a specified date should retain the existing RO end date. However, a significant minority thought that all plant, regardless of when it was built, should be entitled to 20 years operation.
- Support for 10% headroom, although some respondents thought it should be introduced earlier.
- Support for the wholesale price stabilisation mechanism appears equivocal, with a significant proportion questioning its benefits.
- Mixed response on trading with those in support outlining a number of issues for further consideration.
- General support for 2 ROC uplift for offshore wind.

Overview of UK Government's Marine Energy Policy

Setting the context for developing marine energy in the UK

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Supporting innovation - marine energy



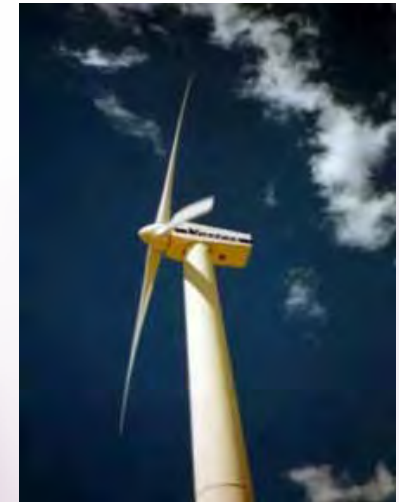
Filomena La Porta, Lead Technologist,
Energy Generation & Supply

Inverness 12 November 2009

To put it in context...

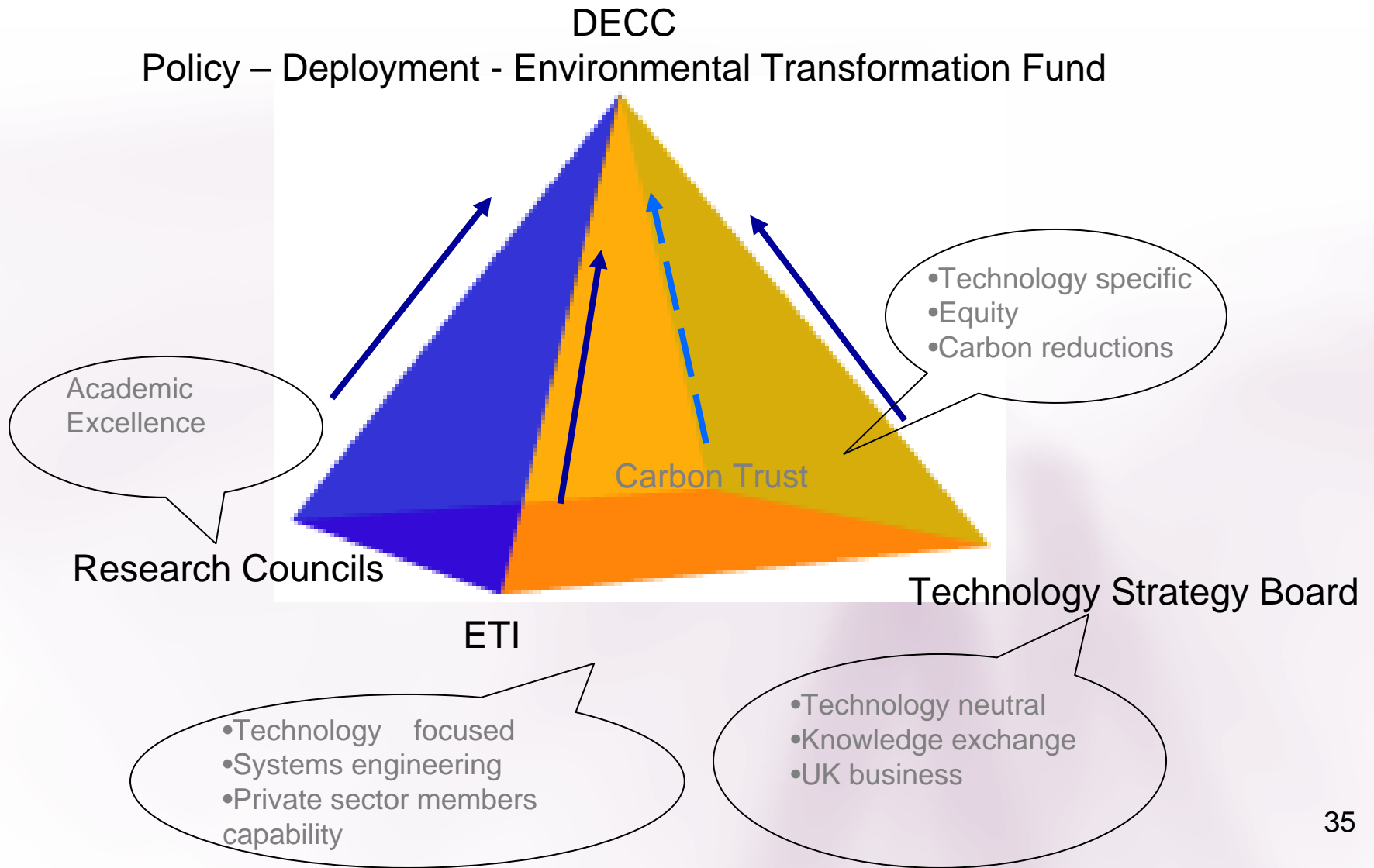
Life in 2020

- More than 1.2 million people will be in 'green' jobs.
- **Around 40 percent of electricity will be from low-carbon sources, from renewables, nuclear and clean coal.**
- **We will be importing half the amount of gas that we otherwise would.**
- The average new car will emit 40 percent less carbon than now.
- 7 million homes will have benefited from whole house makeovers, and more than 1.5 million households will be supported to produce their own clean energy.



Technology Strategy Board

Driving Innovation



What is the Technology Strategy board doing?

Our challenge

- **CO₂ reduction**
- **Security of supply**
- **Affordable electricity**

AND

- **Wealth creation for the UK**

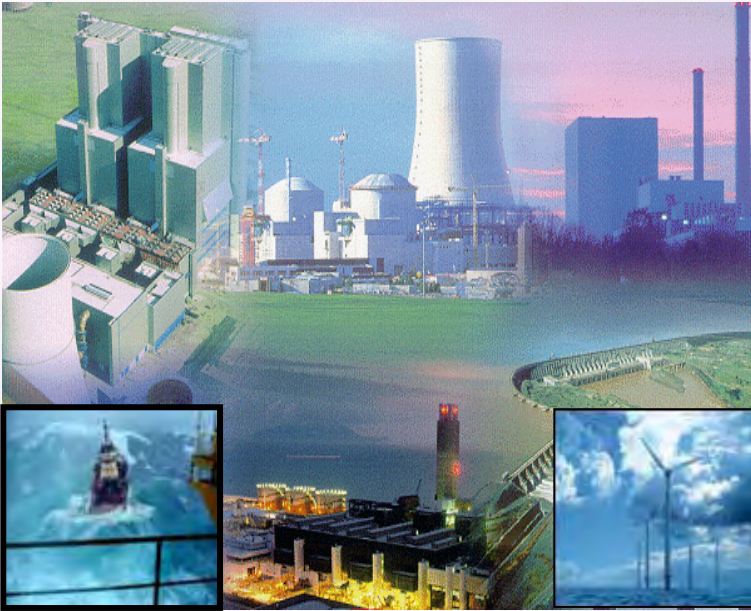
Market	Capacity
Timing	Added value

“...the overall value added of the low carbon energy sector could be as high as \$3 trillion per year worldwide by 2050, it could employ more than 25 million people in jobs. If Britain maintains its share of this growth there could be over a million people employed here in our environmental industries within the next 2 decades”. **Gordon Brown**

Technology Strategy Board

Driving Innovation

Low Impact Buildings Innovation Platform



Energy Generation & Supply
Application Area



Low Carbon Vehicles
Innovation Platform

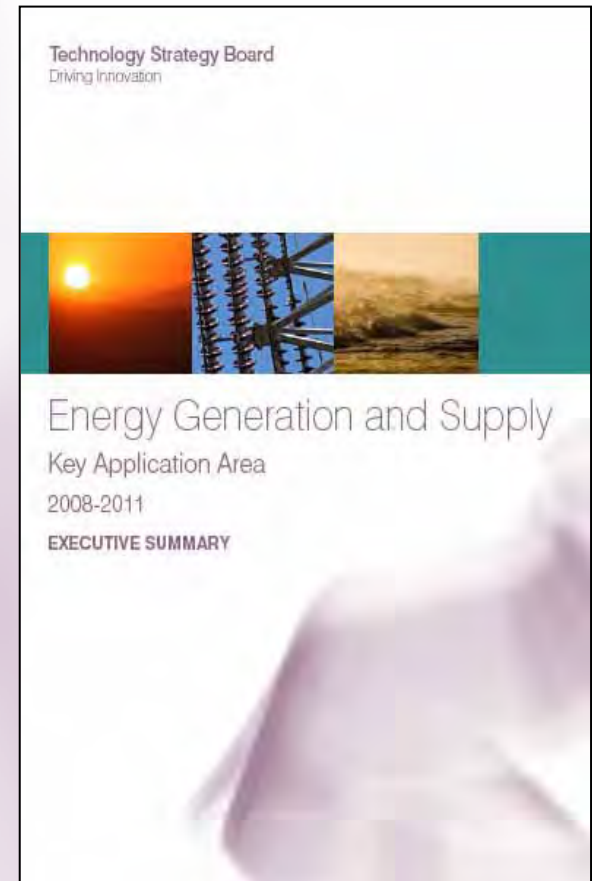
Technology Strategy Board

Driving Innovation

Energy Generation and Supply Strategy May 2008

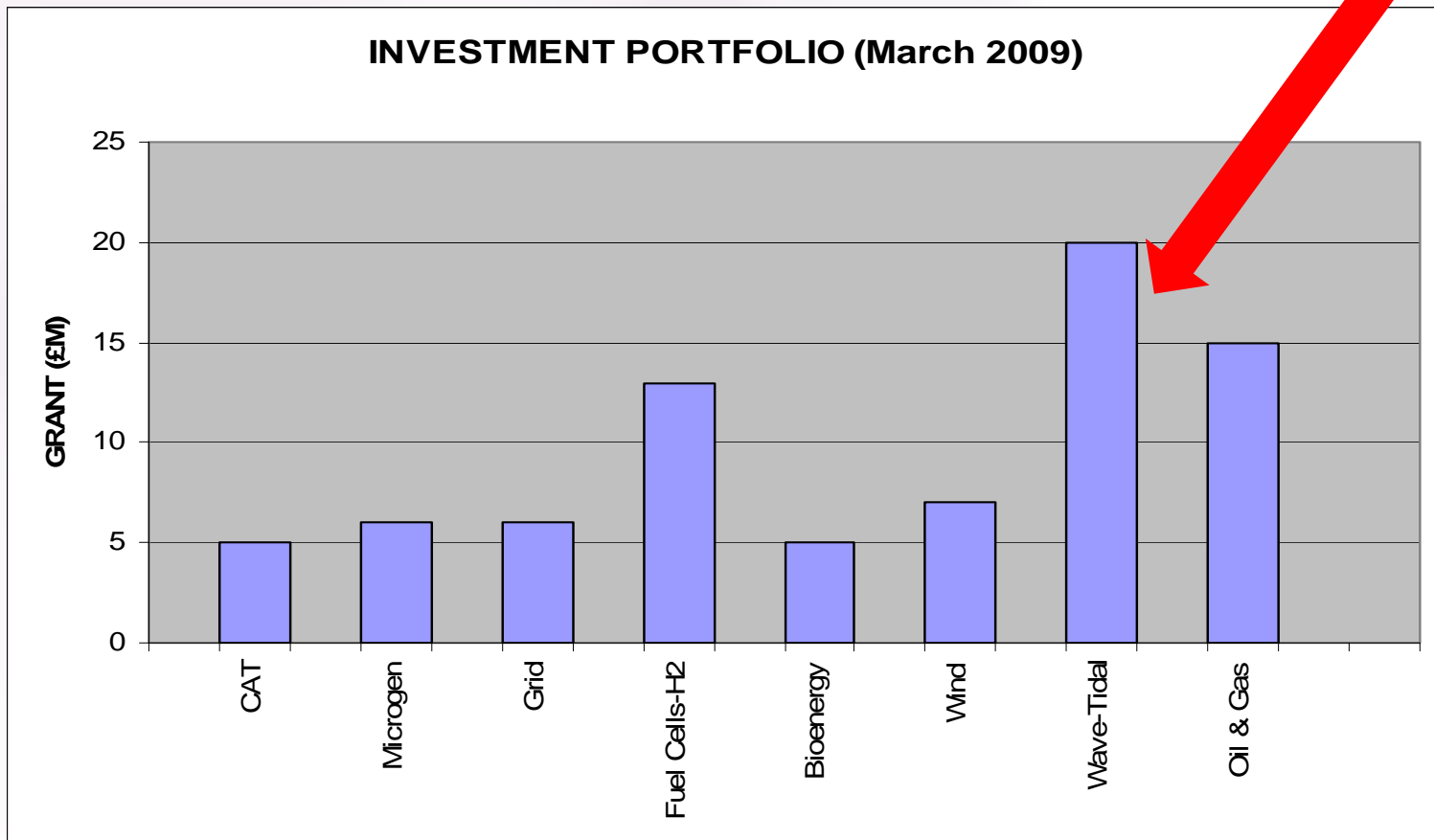
- Directly invest in carbon abatement, fuel cells, hydrogen and oil and gas technologies.
- Support offshore wind, wave and tidal technologies through ETI. **Ensure that UK businesses are engaged & well positioned.**
- Further analysis of UK capacity and added value in bioenergy, intelligent grid and nuclear.
- Work with other Technology areas and Innovation Platforms in Microgeneration & biofuels.
- Support knowledge transfer through establishment of KTN

Market	Capacity
Timing	Added value



Current Portfolio-energy generation (to March 09)

A portfolio of ~130 projects,
with total value of ~£165M (~£75M grant)



Technology Strategy Board

Driving Innovation

Listening to

Individual businesses
BWEA

Scottish Marine Energy Roadmap
Recommendation.....

**“TECHNOLOGY STRATEGY BOARD
should open a funding round for marine
energy technology development”**



Oyster device © Aquamarine Power Ltd



P 1-A Pelamis machines at Aquacadura © Pelamis Wave Power

.....Initial Plans for 2010

Spring 2010 Collaborative R&D competition Wave and Tidal Stream Energy



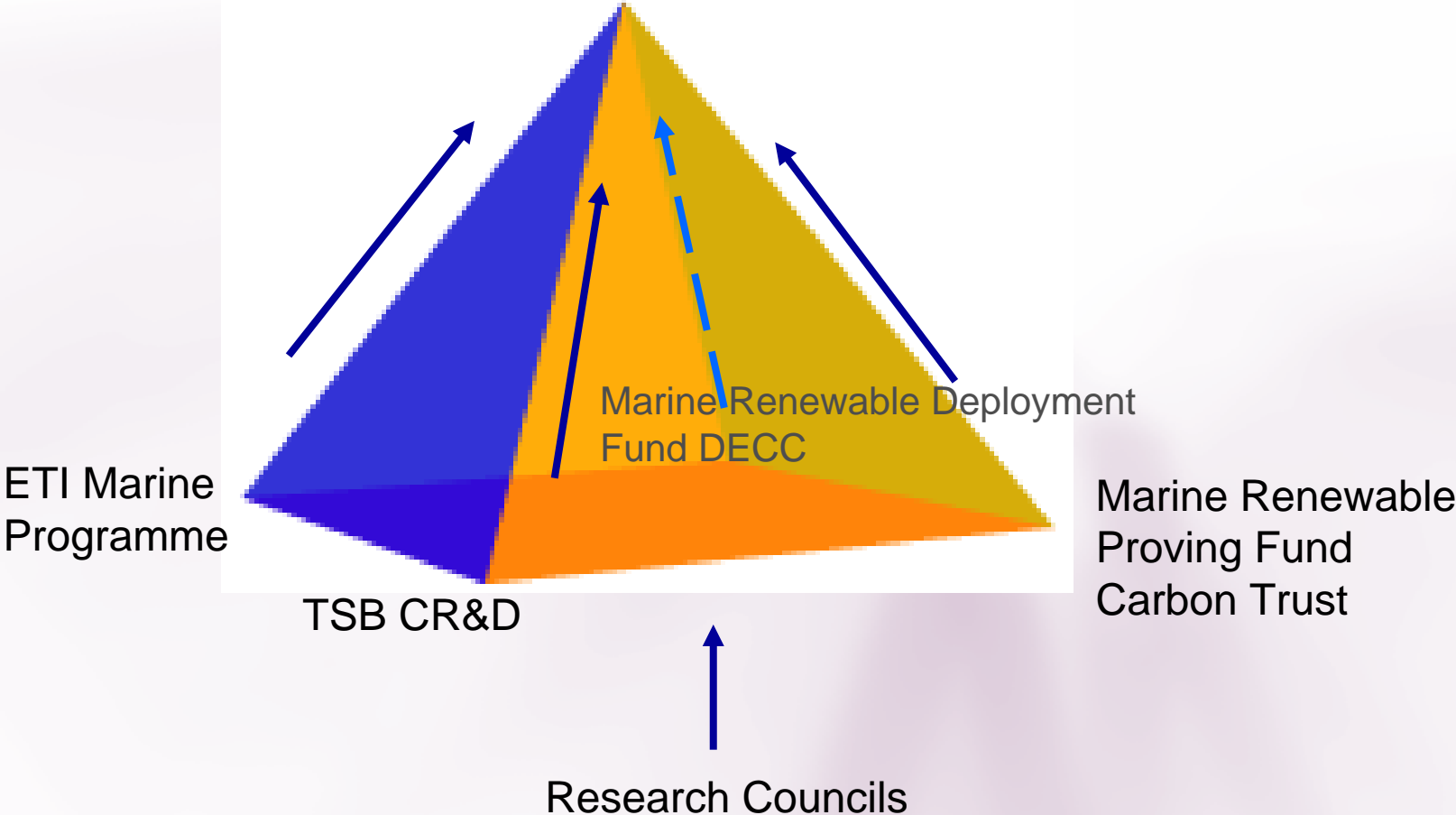
Cyster device © Aquamarine Power Ltd



Technology Strategy Board

Driving Innovation

UK Renewable Energy Strategy
Wave and tidal stream energy deployment



TSB Marine Competition Context

- Up to £10m for 3-4 year collaborative projects.
- Part of a coordinated programme with DECC and the Carbon Trust
- Applied R&D **and** Experimental Development in devices, supply chain & operating environment (for current and emerging technologies).
 - improved performance and efficiency,
 - cost reduction,
 - accelerating deployment,
 - 2nd generation technologies.
- Direct impact on wealth creation
- Consultation with sector over next 3 months

Scope

For example projects that will focus on:

- Full scale and next generation full scale devices building on MRPF e.g.
 - Contributing to the achievement of continuous operation and performances required to access MRDF, cost reductions, upscaling, grid connection etc...
- Gathering and analysing performance data and feedback from sea trials => address lessons learnt (e.g. post MRPF, during MRDF, not fully scaled up...)
- Electricity generation, supply chain and environmental issues
- Breakthrough and next generation devices only where there are significant cost reduction and efficiency improvements

Timescales



Winter 2010 TSB projects selected

Breakthrough
concepts



Questions

- Is the scope right?
- What are the priorities?
- Is the timing right?
- Can industry afford it?

Technology Strategy Board

Driving Innovation

We understand that

- Need to work together more on common problems
- Need to be able to deal with unknown challenges
- Protect IPR

Compilation of Best Practice/Lessons Learnt

What would you be prepared to share?

Scope?

We want your help to shape possible future programmes

In what broad challenge areas are you prepared to work together

1. As an industry
2. With other in supply chain
3. With academia

Technology Strategy Board

Driving Innovation



Thank you



Filomena.laporta@tsb.gov.uk

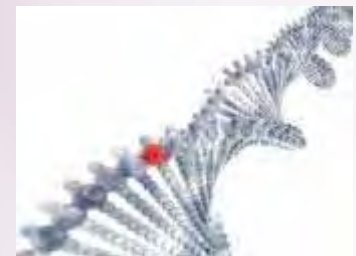
Technology Strategy Board

Driving Innovation

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Scottish Renewable Energy Infrastructure Plan

12 November

Euan Dobson

Wind, Wave and Tidal energy

- What? - Infrastructure Requirements – Wave/Tidal, Offshore Wind
- Where? - Process and “first wave” sites
- How? - A focused and aligned delivery approach
- With What? - sourcing private and public sector investment
- Issues and Opportunities
- Next Steps

Renewables Infrastructure Plan – N-RIP

Scottish Government Renewables Action Plan – June 2009

Clear Spatial Framework

- Infrastructure Dependencies – logistics, port operating regimes, planning/consenting regimes

Process

- informed dialogue - ongoing
- Bremerhaven and Stakeholder Session

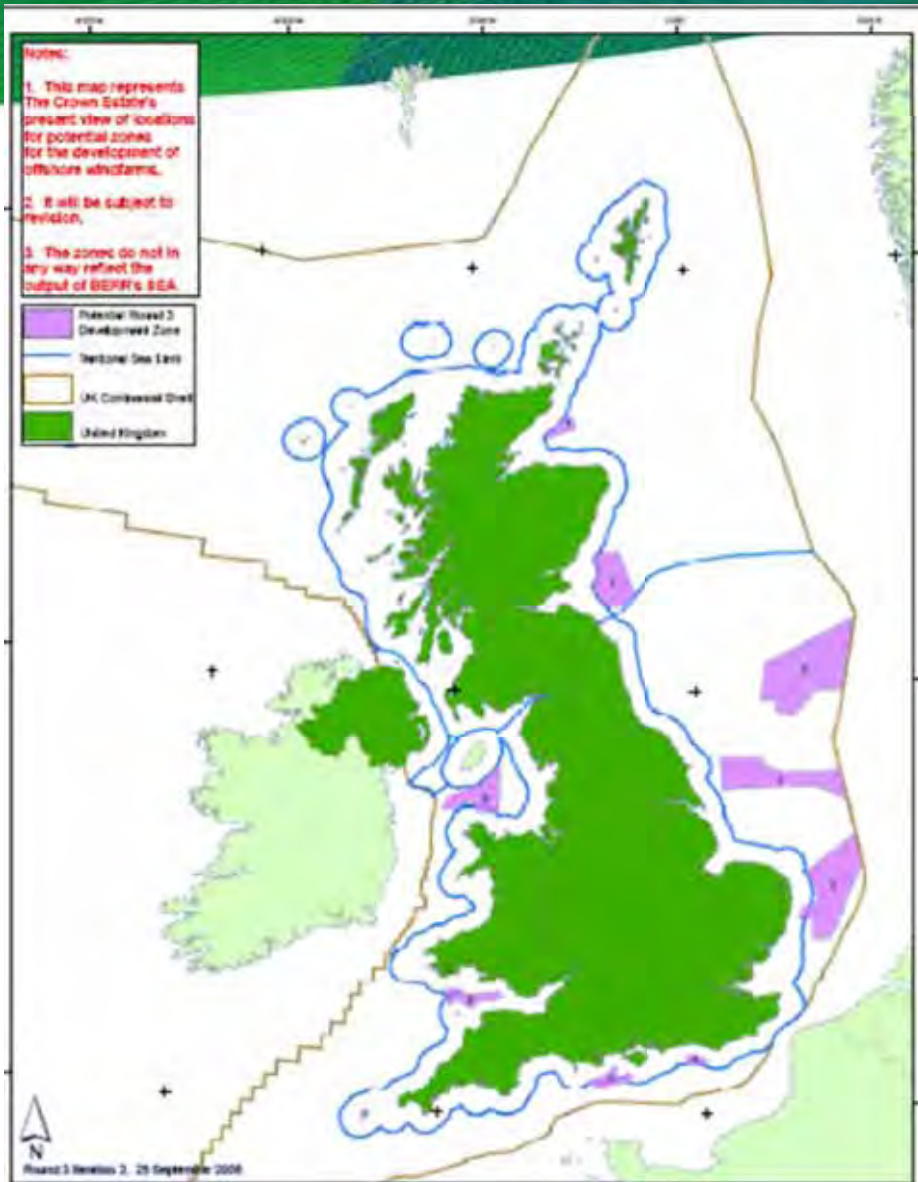
Drivers

- Round 3, STW, Pentland Firth and Orkney Waters, future wave and tidal locations
- other port uses – ferries review, cruise infrastructure review, multi modal study
- Decommissioning

Outputs - clear spatial framework - investment requirements –
delivery approach - funding



Scotland's Offshore Wind Opportunity – R3 and STW



Round Three sites in Scotland

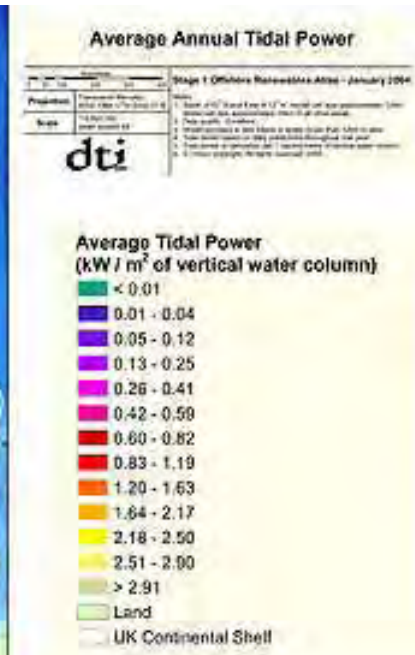
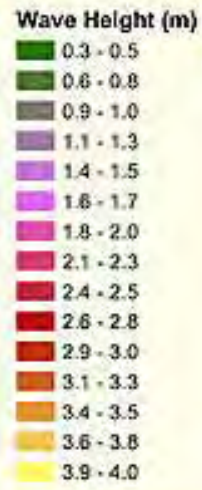
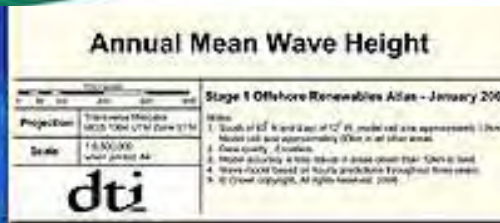
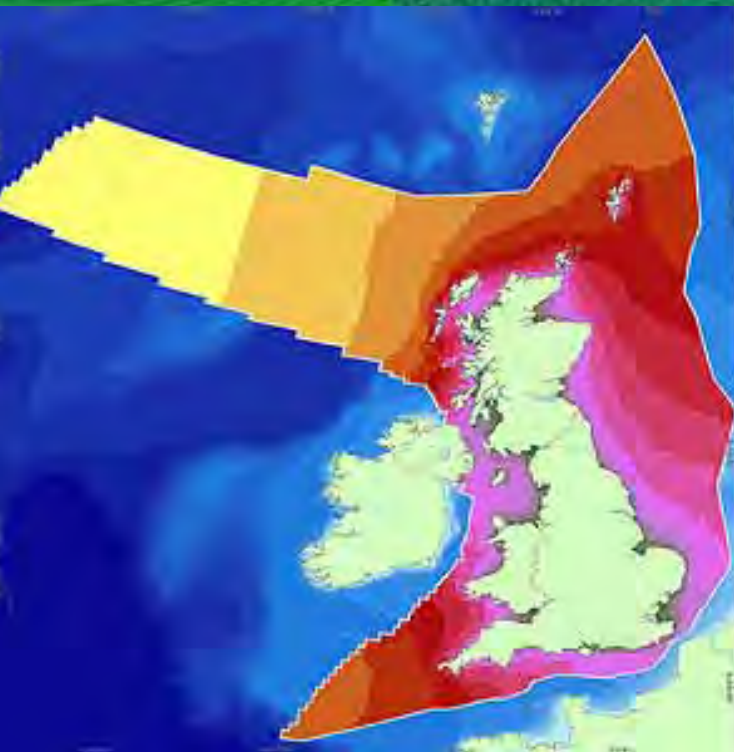
- Moray and Cromarty Firths (expected 2-3GW)
 - Forth and Tay Estuaries (3-5GW)
 - Build start dates 2014/15

Scottish Territorial Waters Round (6.4 GW)

- 10 sites – 5 on the West Coast and 5 on the East Coast
- Expected to total 6.4GW
- Build start dates in 2013

Scotland's Wave and Tidal Resource

Scotland's position at the end of a long Atlantic Ocean fetch produces tremendously energetic waves



Scotland has over 70% of the UK's tidal power which has been estimated at 13 billion Kilowatt hours per annum

Wind v Wave/Tidal Different Stage – Different Infrastructure

Offshore Wind

- Implementation “now” – next 12 months key
- Large structures
- Large developers and licence holders
- Need for action now

Wind v Wave/Tidal Different Stage – Different Infrastructure

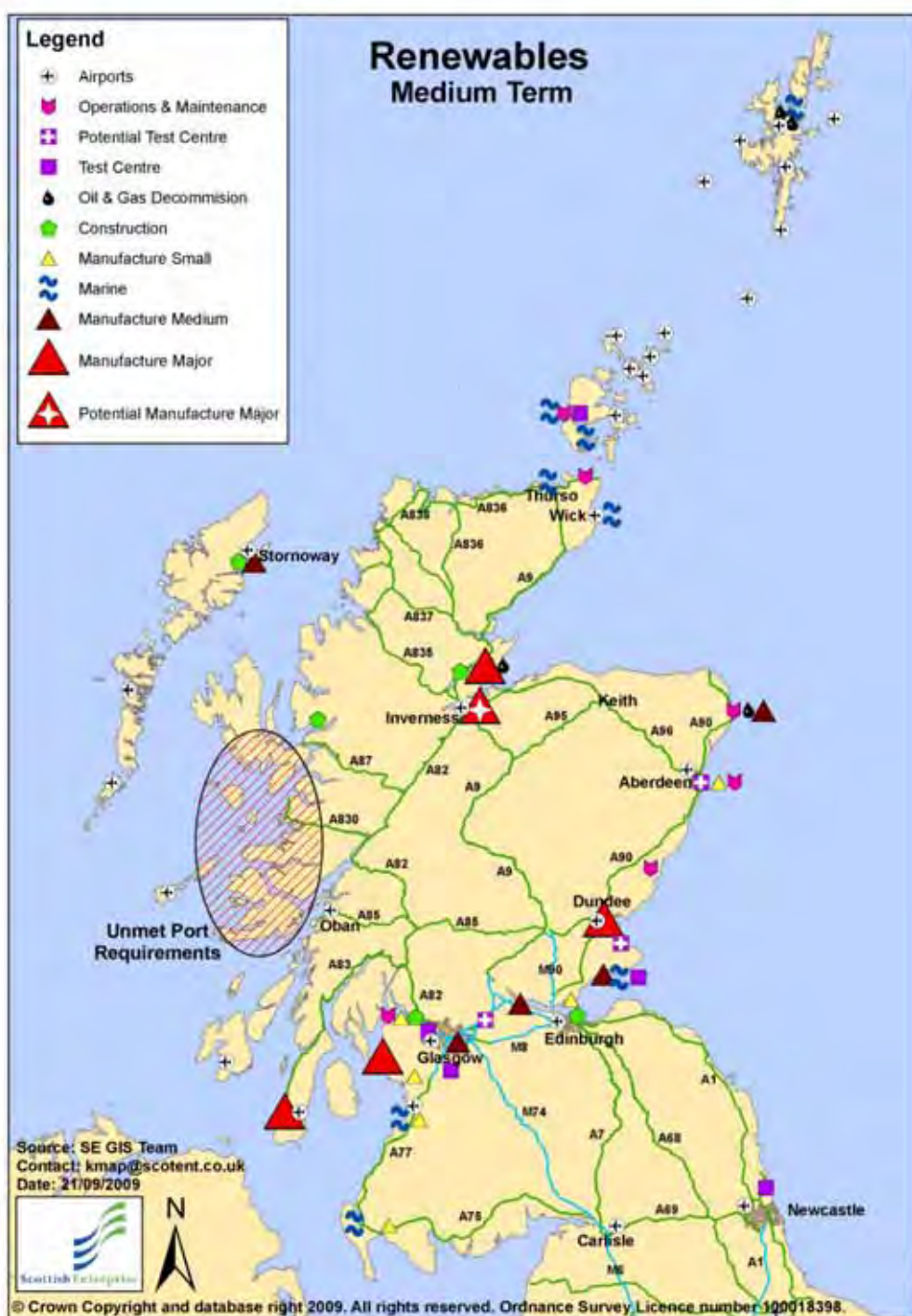
Wave and Tidal

- **Testing Phase - 700mw by 2020 – Pentland Firth and Orkney Waters first...**
- **Infrastructure to anchor test sites... to entice development, early manufacturing...**
- **North and Islands first..... South West Scotland, Western Isles follow (fast?)**
- **Staged/ phased infrastructure investment**
- **Pentland Firth and Orkney Waters “Triangle” – Lyness, Scrabster, Wick**
- **“Provisional Preferred Bidder” discussions as part of N-RIP**



Future Needs and Locations

- Indicative Map of Locational Requirements
- Based on Strong Growth of Industry Supply Chain
- Industry will drive use
- Need Alignment of Govt and Industry investment
- **Triggered Investment in a First Wave of sites**



Fast Forward Timescale

New Energy Scotland Delivery Group – convene early December

- **Costed investment plans developed**
- **Installation – fastest location study**
- **Simplified Support offering**
- **Tell Scotland’s new energy story**
- **Drive investment funding search**

Issues and Opportunities

Issues

Gap Funding

Anchoring economic benefits of testing locations

Marine Operations

Where Next? – first mover advantage

“No Regret” Investment – future uses

Opportunities

Installation Methods and Consortia

Floating/Mobile Infrastructure for remote locations – joint research and prototyping

Local production

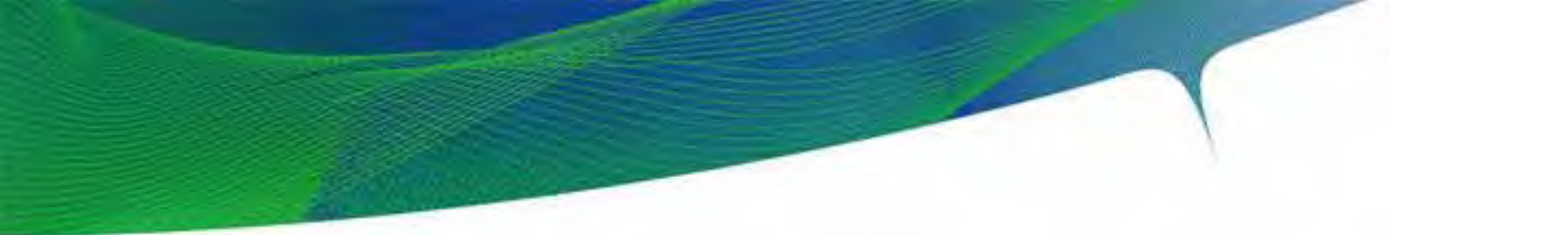
Local operation and maintenance

.... but supporting globalising companies and supply chains

Key Points - Summary

- Wind - Fast Forward Strategy – ready by 2012/13
- Wave/Tidal – urgent but staged
- further dialogue with Pentland Firth/Orkney Waters companies
- First Wave Investment Strategy – Triggered
- Delivery Alliances – SE/HIE with Ports and Developers
- New Energy Scotland Delivery Group – increase momentum and ensure systematic approach







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OCEAN ENERGY

A European Perspective

Nathalie Rousseau
Executive Director

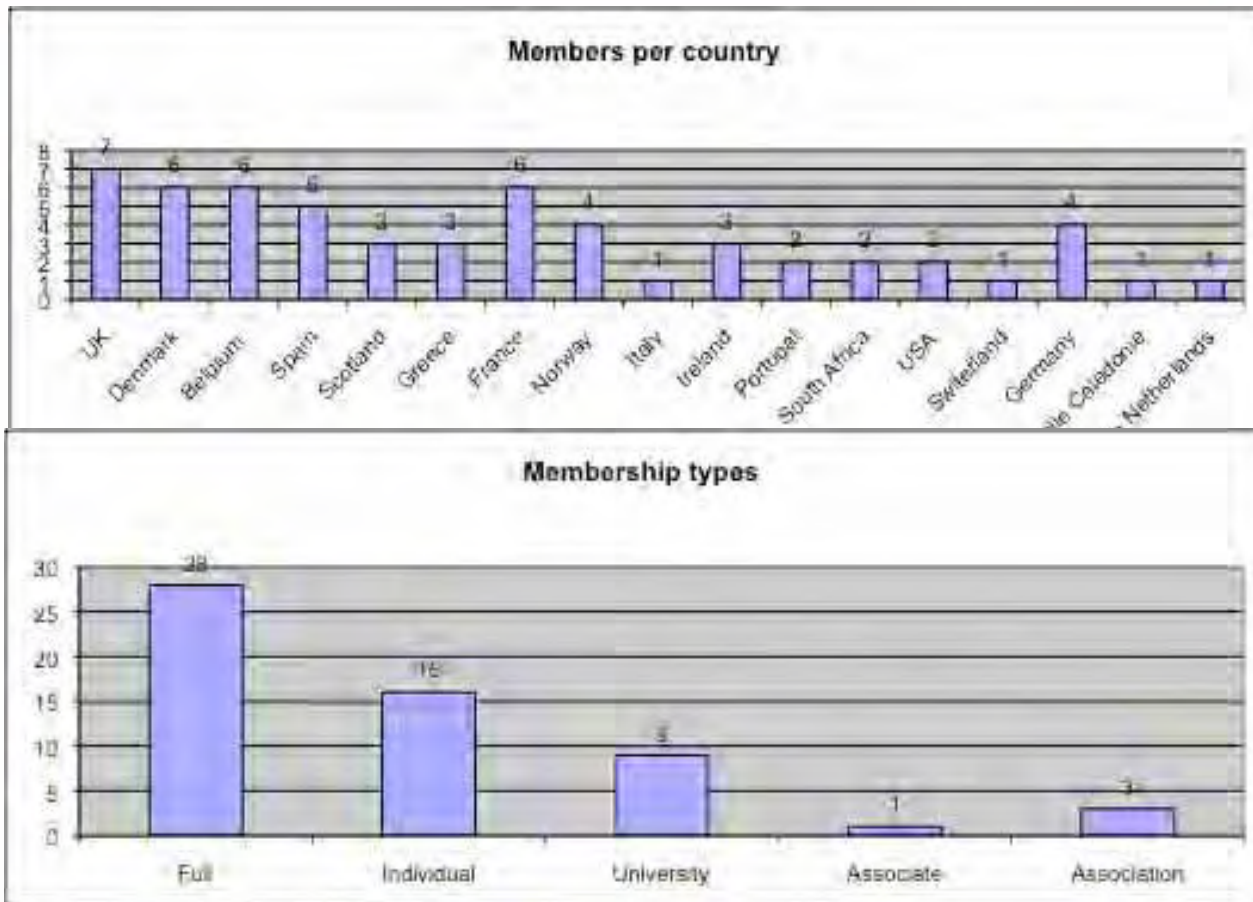
www.eu-oea.com

Scottish Renewables Forum,
Inverness

EU-OEA

- Formed in 2006, office established in 2007 in REH
- Goals & Objectives:
 - To strengthen development of OE sector in EU
 - To act as the central network for our members
 - To promote benefits of the OE sector
 - Act as the single OE sector voice to the EC
 - Impact OE policies and EC programs

EU-OEA Membership



EU-OEA Achievements to date

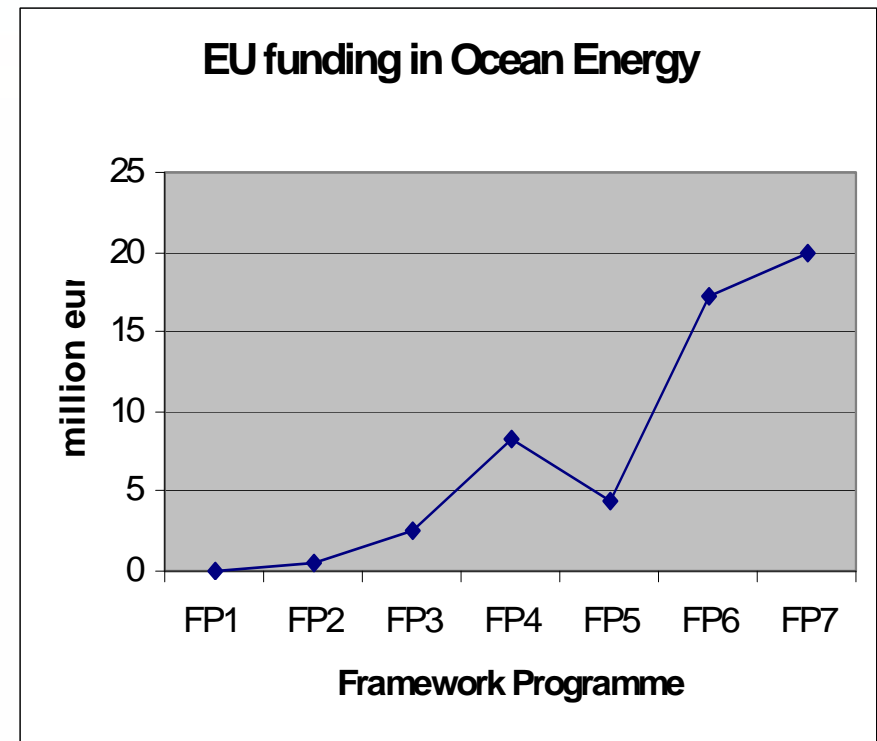
- **Close working relation with EC Dir Gens**
 - Input on future funding programs, position papers & responses to EC communications; ...
- **Data collection and dissemination**
 - EC projects - SSA, WAVEPLAM, EquiMar, ORECCA, AquaRet2
- **Ocean Energy awareness**
 - EU Maritime Days May 19 & 20, 2010
 - Industry exhibit coordinator for ICOE2010

Strategic Energy Technology (SET) Plan

- One of the main energy policy drivers
- Goals & Objectives
 - Align technology development with energy policies & to allow Joint Strategic Planning
- Implementation
 - European Industrial Initiative
 - European Energy Research Alliance
 - Trans-European Energy Networks and Systems

EC funding for Ocean Energy

- To date EC funding:
~55 M€
(DG RTD & DG TREN)
 - FP 7 (first 2 years) 20,0 M€
 - FP 6 17,3 M€
 - FP 5 4,5 M€
 - FP 4 (Joule III) 8,2 M€
 - FP 3 (Joule II) 2,5 M€
 - FP 2 (Joule I) 0,5 M€



EC funding – New Entrants Reserve

- **Dir General for Environment**
 - Reserve budget of the ETS
 - 300 M€ for innovative, renewable energy technologies
- **List of eligible projects includes 2 open topics for OE:**
 - Wave energy with a nominal capacity of 5 MW
 - Tidal energy with a nominal capacity of 5 MW

European Investment Bank

- EIB = structured finance for energy & environment
- EIB shareholders : 27 MS
- Annual lending : 47,8 bn € (2007)
- Energy sector : 1,5 bn € (2007) of which 33 % to RES

European Investment Bank

- Financial instruments :
 - traditional loan products
 - new instruments for sustainable energy projects

European Investment Bank

- Traditional loan products :
 - senior and subordinated loans
 - corporate loans & project finance
- Loan term up to economic life of the assets
- Loan amount generally up to 50 % of eligible project cost

European Investment Bank

- Large scale projects (typically >50 m€)
 - direct investment loans
 - corporate loans & project finance
 - single or multiple sites
 - comprehensive loan appraisal justified by project size
 - EIB takes full risk, loan amount capped at 200 m€.

European Investment Bank

- Small to med. scale projects (<50 m€)
 - programme or framework loan
 - intermediaries are financial entities
 - EIB now willing to provide loan facilities to developers for bundling small-scale projects.

SET Plan OE position paper

- State of the art
- Market and industry status and potential
- Impacts analysis
- Barriers
- Needs
- Synergies with other sectors

EU roadmap for OE development

- **Goals & Objectives**

- Define and implement mechanisms leading to commercial exploitation of Ocean Energy in EU

- **Results**

- Define commercialisation parameters:

- To be implemented by EU Member states
- Leading to advancement of OE to commercial level

- **Implementation**

- Conduct discussions/presentations with EU member states
- Present at various Ocean Energy events

Implementation Scenarios

Year	2020	2025	2030	2040	2050
Scenario A [GW, cum]	8	15	20	66	85
Scenario B [GW, cum]		12	12	68	85

Scenario A - accelerated development rate, with other technologies developing in a “business as usual” manner.

Scenario B - all generation technologies are accelerated development

EU roadmap for OE development

- **Path forward**

- Communicate sector vision and capacity targets
- Work with Member States to build their Road Maps to have a joint plan of action
- Bring together critical mass for a European Industrial Initiative on OE

- **Final Report**

- Open workshop on 27th Oct 2009, REH, Brussels
- Submission – November 2009

Marine Energy Group Road Map

- EC should recognize the potential of marine energy, particularly in the medium to long term, through funding further R&D and demonstration projects → FP7 and the New Entrants Reserve
- MEG, SEGEC, EU-OEA and the EC should consider how EU funding mechanisms in the next funding period (2014-20) can be adapted to ensure the most effective support for the large scale development of marine renewable technologies → SET-plan main driver for FP8



Rational for European Initiative

- Led by industry
- Shared risk – highest risk to be taken by the industry
- Foster public – private partnerships & pool public and private financing
- Main goal : to boost R&I, deliver progress beyond BAU, define and realize clear targets that contribute to political goals

Conclusions

- **RES-Directive**
 - Binding renewables target of 20% of EU consumption by 2020
 - Increases investor's confidence and encourage substantial investment
- **Ocean Energy**
 - Can be a major contributor for 2030 and 2050
 - EII can pull the critical mass together
- **Need collective actions NOW!**



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the next steps*

finance - getting on the curve





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