

Energy Technologies Institute (ETI)

Response to the Energy and Climate Change Committee Inquiry into The Future of Marine Renewables in the UK – September 2011

Summary

1. The ETI's modelling of future UK energy system options consistently highlights marine as a potential part of future UK electricity generation base alongside major contributions from fossil fuels with Carbon Capture and Storage (CCS), bioenergy, nuclear and wind.
2. In the context of (3) and (4) below, marine energy can be seen as important for the UK but not the highest priority or lowest risk development for establishing the country's future energy system. It is however an important part of potential 'hedging options' to ensure the UK has a balanced portfolio of fuel and electricity sources available to ensure delivery of sustainable, secure and affordable energy for consumers.
3. Tidal stream energy appears as a significantly more important development than wave energy and occurs in around 75% of potential 2050 system design options identified through ETI's 'ESME' modelling. ESME focuses on identifying the lowest cost options for the UK's energy system out to 2050 and the likelihood of deployment of specific technologies. Wave energy appears in less than 50% of potential system options.
4. ETI assessment of UK energy system options for 2050 estimates the additional system costs to the UK of not introducing marine energy systems (wave and tidal) as between £0.1bn and £0.4bn per year by 2050 (in money of 2010). The equivalent 'option value' for nuclear energy is £5-10bn per year and for CCS over £60bn per year. Nuclear and CCS appear in over 98% of system design options.
5. In the event that a constraint develops in the take-up of other generating sources such as nuclear, biomass or onshore wind then the 'hedging option' of marine energy will become more important.
6. Achieving cost competitiveness with other generation systems will be critical if marine energy is to be available as anything more than a 'niche deployment' in the UK. To sustain commercial investor engagement the marine energy industry must demonstrate in the next 5-8 years the potential to move towards a cost competitive position compared to other low carbon energy sources – particularly offshore wind.
7. Intervention is needed to support immediate activity to demonstrate cost reduction approaches for installation, deployment and through-life maintenance of arrays of devices. ETI is currently developing new projects to enable cost reduction on array installation and through-life operation. ETI has already invested over £21m in marine energy development and demonstration projects.
8. Until significant cost reduction has been demonstrated on arrays the industry will not be able to deliver electricity which is competitive to alternatives without some form of subsidy. Continued medium to long-term support through the ROC system (or similar) will be essential to incentivise and reassure project developers, financiers and engineering developers who will have other investment options.

9. As well as incentives for electricity delivery the Government must send continued signals of assurance, favourability and long-term consistency of policy towards the sector to ensure major industrial groups will commit continuing support and business engagement.
10. These signals must address all critical elements of the technology, supply-base and project deployment value chain. The development of the Offshore Renewables Technology Innovation Centre (TIC) is an important part of this to encourage technology investment in the UK whilst a “premium” level of ROCs (higher than today) for Marine Energy is likely to be necessary to demonstrate commitment and accelerate initial project developments.

Context

11. Marine energy systems offer the potential for production of electricity from a fuel source (tidal stream or wave) which is ‘free’ although intermittent and only partially predictable. Tidal energy can be considered a more valuable market commodity than wave since tidal flows are generally very predictable (months, years in advance) whereas wave is only predictable to any degree of accuracy a few hours ahead of real time. The UK has some of the largest marine energy resources in the world, particularly off North Scotland and the South-West of England and Wales.
12. The skills for developing, manufacturing, installing and supporting marine energy devices, systems and installations are largely available within the UK’s existing marine and offshore industries however delivering these skills through safe practices using cost effective assets (boats, ports etc.) is critical if marine energy is to deliver electricity which is cost competitive with other sources.
13. The UK has a significant capability base in marine energy which is being exploited on a global basis. Until recently the industry has been largely dominated by UK SME groups. There are however, now a number of device developers and deployment specialists from mainland Europe and North America entering the UK market coupled with a growing range of multi-national equipment supply groups acquiring UK SME capabilities. This is an important development in ensuring effective scale-up of capability and reflects a degree of increasing industry confidence, however, the majority of these groups are entering the market on the basis of the ability to attract government support for technology development. There is very limited wholly private financing of technology developments and demonstrations.
14. The ETI carries out modelling and analysis of the UK energy system to allow identification of key challenges and potential solutions to meeting the UK 2020 and 2050 targets at the lowest cost to the UK. Where there is additionality the ETI then invests in major engineering and technology demonstration projects which address these challenges with the aim of reducing risk – both in technology and in supply-chain development – for subsequent commercial investors.
15. The ETI’s UK energy systems modelling focuses on establishing the most cost effective options for the UK. The ETI’s system modelling toolset (‘ESME’) has been assessed alongside other tools available to HMG and shown to provide a unique viewpoint for presenting system level choices, uncertainties and eventual economics, together with

analysis of the required supply chains. Tidal stream, wave and tidal range (barrages) are included in ETI's modelling.

Potential contribution of marine energy to delivering UK energy goals

16. The ETI's modelling of future UK energy system options consistently highlights marine as a potential part of future UK electricity generation base alongside major contributions from fossil fuels with Carbon Capture and Storage (CCS), bioenergy, nuclear and wind (onshore and offshore). Tidal stream energy systems appear as a significantly more important development than wave energy systems and occur in around 75% of potential 2050 system design options identified through ETI's ESME modelling. Wave energy appears in less than 50% of the potential system options.
17. ETI assessment of UK energy system options for 2050 estimates the likely additional system costs to the UK of not introducing marine energy systems (wave and tidal) is between £0.1bn and £0.4bn per year by 2050 (in money of 2010). This is termed the 'option value'. For comparison the equivalent option value for nuclear energy generation is of the order of £5-10bn and for Carbon Capture and Storage over £60bn.
18. The likely level of marine energy capacity deployed in 2050 appears to be between 5GW and 10GW nominal capacity, depending on the ability to establish early cost competitiveness (in the cost of electricity delivered to the grid) compared to alternatives such as offshore wind.
19. Achieving cost competitiveness with other generation systems will be critical if marine energy is to be taken up as anything more than a 'niche development' in the UK. The ETI has worked extensively with the UK offshore renewables industry and trade associations to develop a robust view on the targets the industry must address to make a significant impact in the UK energy market. These targets have been documented and published in the 'ETI / UKERC Marine Energy Technology Roadmap' published in November 2010.
20. The ETI / UKERC Marine Energy Technology Roadmap sets a 2050 target for the Levelised Cost of Energy (LCoE) from Marine of 5-8p/kWh. This would be competitive with anticipated costs for offshore wind.
21. Without intervention from outside the industry the Levelised Cost of Energy (LCoE) for tidal stream is expected to be in the range of 6-13p/kWh by 2050 and higher for wave energy. This wide range indicates the degree of uncertainty in how the industry might develop. At these levels marine energy is unlikely to be viewed as a competitive electricity source and the industry will not be viable without significant, long term subsidy.

Effectiveness of interventions to date

22. Government support to date has been effective at enabling the establishment of a number of UK power conversion device developers (tidal stream and wave). Most of these groups are SMEs. The challenge for these companies now is two-fold :
 - a) demonstrating reliability, efficiency and cost effectiveness on their particular machines and;

- b) establishing adequate business development and scale-up capability to allow them to provide effective delivery and support to longer term array development and system deployment projects.
23. The steady engagement of major private sector utilities and engineering manufacturers with many of the UK's leading (SME) device developers suggests there is confidence in the embryonic technology and these groups have the capabilities to ensure that both of the challenges above are addressed effectively. On this basis there appears to be a limited case for continued Government support for device development. The critical issue now is ensuring a strong focus on array deployment, demonstration and cost reduction.
24. The Low Carbon Innovation Group under the leadership of DECC and BIS is proving to be a valuable vehicle for sharing strategic information and developing opportunities for communication and integration of investment plans and policy development by a number of groups linked to the public sector. ETI was a founding member of the LCIG along with the Carbon Trust and Technology Strategy Board. ETI's ESME modelling system is being used by the LCIG to inform technology investments across a number of areas including marine energy.

Required action

25. The next 5-8 years will be a critical phase in development of the marine energy industry. If the industry cannot demonstrate in this period the potential to move towards a cost competitive position then it is unlikely to progress against competition from other low carbon sources – other than as a niche solution in very specific geographic locations where either alternatives are not practical or there are local economic and social development reasons for subsidies. In either case affordability will be challenging for consumers and government.
26. Intervention is needed to support immediate activity to demonstrate cost reduction approaches for installation, deployment and through-life maintenance of arrays of devices. Without near-term improvements in these areas potential array project finance support from the investment markets is likely to reduce as increasing commitments are made towards alternatives such as wind projects (offshore and onshore) which will be perceived to offer lower risk on returns. It is critical that strong focus is created on array deployment, demonstration and cost reduction.
27. ETI is currently developing new projects to enable cost reduction on array installation and through-life operation for both tidal stream and wave. ETI has already invested £21m in Marine Energy system and sub-system development and demonstration projects.
28. The marine energy industry remains immature and the extent to which major industrial groups will commit continued support will be dependent on perceived assurity, favourability and long-term consistency of Government policy towards the sector.
29. Until significant cost reduction has been demonstrated on arrays the industry will not be able to deliver electricity which is competitive to alternatives without some form of subsidy. Continued medium to long-term support through the ROC system (or similar) will thus be essential to incentivise project / array developers, financiers and engineering developers who will have other investment options. A “premium” level of ROCs (higher

than today) for Marine Energy is likely to be necessary to demonstrate commitment and accelerate initial project developments.

30. In parallel with ensuring consistent long-term policy ('demand and return') signals are sent to industry it is important that the relevant national issues of appropriate grid connections, manufacturing sites, installation support infrastructures and technology development support (science base and test facilities) are considered and appropriate solutions committed ahead of need. This will be a key element in both ensuring early development of the industry and ensuring that economic value is captured in the UK rather than being allowed to transfer into other countries.
31. The ongoing development of the Offshore Renewables TIC (Technology Innovation Centre) by the Technology Strategy Board is an important part of ensuring the UK engineering, technology and science base is seen as a significant benefit to major engineering, manufacturing and product support companies who will be considering global industrial development options – both on whether to invest in Marine Energy and whether to then invest in the UK or elsewhere.
32. Ongoing support for skills and capability development will be important. This can build effectively on the wide range of programmes and centres being developed to support the offshore wind industry. For instance, the recently launched £6.5m Industrial Doctorate Centre in Offshore Renewables being funded by the ETI at the Universities of Edinburgh, Strathclyde and Exeter will deliver training which will aid in creating future leaders in both the Marine and Offshore Wind industries.

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Context and background on ETI

33. The ETI has two modes of operation – (1) modelling and analysis of the UK energy system to allow identification of key challenges and potential solutions to meeting the UK 2020 and 2050 targets at the lowest cost to the UK, and (2) investing in major engineering and technology demonstration projects which address these challenges with the aim of de-risking solutions – both in technology and in supply-chain development – for subsequent commercial investors.
34. ETI has 6 industry members (BP, Caterpillar, E.ON, EDF, Rolls-Royce and Shell) who offer complementary capabilities in the energy area. Their financial support (£5m p.a. each), skills, business capabilities and market access routes are made available to the Government through the ETI partnership structure. HMG (through BIS) provides matching support to industry member financial contributions. ETI invests in projects as a commercial entity, it is not a grant awarding body.
35. ETI's in-house strategic modelling capability has been developed with the strong involvement of the UK industrial base (not just ETI Members). The ETI capability addresses the full UK energy system and centres on first developing robust, shared understanding of critical issues for the UK in reaching 2020 and 2050 energy targets.
36. Having identified the key engineering and technology barriers associated with achieving the 2020 and 2050 goals the ETI then establishes projects to demonstrate potential solutions to these challenges. This approach forms a key part of demonstrating the industrial capabilities needed to meet the UK's future needs, incentivising industry by informing them of the potential business opportunities and creating the embryonic supply-chain and skills to deliver solutions for the UK.
37. To date the ETI has invested in over £128m of projects to benefit the UK. £21m of these are targeted at Marine Energy systems. ETI is currently developing further projects targeted at reducing the cost and risk in deployment of future arrays of tidal and wave devices.
38. Uniquely, the ETI's energy system modelling focuses on identifying the lowest cost solutions to the UK and provides an assessment of the option value of key technologies in the 2050 energy system (ie; answering the question "what is the cost to the UK of NOT implementing a specific technology?"). The primary modelling tool is a bespoke toolset developed by the ETI and termed 'ESME'.
39. ETI modelling was used by DECC in support of its 2050 pathway work and also supported the Committee on Climate Change (CCC) development of the fourth Carbon budget proposals and the recent CCC Renewables Review. The ongoing 'Technology Innovation Needs Analysis' activity on marine led by DECC is also using inputs from the ETI ESME system. The ETI modelling systems have been successfully peer reviewed by an international review team led by Imperial College.