ENERGY

ENERGY POLICY STATEMENT: 09/07

MARINE ENERGY

Institution of MECHANICAL ENGINEERS

Today the marine energy sector is approaching a 'make or break' point. Nowhere else is this truer than in Scotland. Abundant resources mean that there is enormous potential for Scotland to become a world leader in commercial marine energy generation. Faced with ambitious government targets and tight deadlines, to secure the prize Scotland must act now.

The marine energy industry faces challenges to full commercialisation that must be overcome if it is to fulfil its potential. These are:

- **Technology**, which must be tested in the sea to determine their viability;
- **Funding**. The industry needs capital to support design, manufacture and install first generation prototypes;
- **Skills**. The marine energy environment is highly energetic, yet few engineers have significant experience of such waters. However, the UK has experience of marine operations and subsea environments due to its oil and gas industry. Bringing in these skills will help overcome the challenges associated with marine energy;
- **Grid capacity**. The National Grid is not fit for purpose; grid capacity in areas with marine energy potential is very limited.

In response to these challenges, IMechE recommends:

- **Scotland leads the way** through strong, courageous and consistent political leadership;
- **A £40m fund be developed** to ensure that a sufficient range of well-engineered wave and tidal energy technology can be tested in the ocean environment;
- **Scotland and Westminster work together to find grid infrastructure solutions** that will allow marine energy in Scotland to play its part in meeting the UK's renewable energy targets.

MARINE ENERGY

The UK Government has committed to source 15% of all energy used from renewable sources by 2020, a ten-fold increase from 2006 levels. To meet this target, nearly a third of UK electricity generation is likely to come from renewable sources by 2020, equivalent to 7,000 new wind turbines[1]. Scotland is particularly well placed to respond to this challenge, having world-leading natural resources and a long tradition of engineering innovation. Scotland's resources have the potential to provide 25% of Europe's wind power, 25% of Europe's tidal power and 10% of Europe's wave power[2]. The Scottish Government has recognised this potential and has set ambitious targets of 50% of Scottish electricity demand to be met from renewable sources by 2020, with 31% achieved by 2011.

New technologies will be required to meet the 2020 target of 50% of electricity to be sourced from renewable technologies. It is on this timescale that marine energy can contribute. Derived from wave and tidal power, marine energy technology has developed to the point that the first machines are producing electricity. Indeed, studies have estimated that wave and tidal energy could provide 10% of Scotland's electricity by 2020[3].

The marine energy sector is on the cusp of success. Wave and tidal energy prototypes are being deployed in the ocean for the first time, many of them in Scotland. The durability, maintainability and performance of a range of technologies will be tested and the results will dictate whether the marine energy sector has a commercial future. Although there are no guarantees, the opportunity is too great to allow simply to let it pass by.

THE MARINE ENERGY INDUSTRY

There has been some doubt as to whether the marine energy industry could actually deliver on its potential. However, recent successes have suggested that the hype is more than justified. The main players include:

Wavegen. Based in Inverness, Wavegen have had a shoreline wave device in operation in Islay since 2000 with two more being developed.

OpenHydro have had a 250kW device operating at EMEC in Orkney since May 2008.

Marine Current Turbines' 1.2MW tidal device has been producing electricity since the summer of 2008. Located in Northern Ireland, the device was recently featured on James May's Big Ideas.

Pelamis Wave Power is based in Edinburgh and is the world's leading wave power company, having recently achieved gird connection for three Pelamis units (2.3MW) off the coast of Portugal, with plans for another 20MW. It also has a further 11 units (8MW) planned for installation in Orkney and Cornwall.

Tidal Generation Ltd are now working with project partners to complete the detailed design and install a 500kW tidal stream machine in the Orkney Islands.

Aquamarine Power is based in Edinburgh and is developing both near-shore and tidal devices.

The Crown Estate have received 38 responses from companies and consortia in response to its invitation to developers for commercial-scale marine energy projects in the Pentland Firth.

EMEC. The European Marine Energy Centre is the world's only multi-berth, purpose-built, open sea test facility for wave and tidal marine energy converters. Many of the technologies abovementioned have benefited from EMEC's test facilities on the island of Orkney.

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THE CHALLENGES

So why hasn't the marine energy delivered on its potential yet? Firstly, early enthusiasm may have been over-optimistic. Now, industry and stakeholders are being far more realistic about what it can deliver and by when. Extensive research and consultation with marine energy device developers, investors and governmental organisations has highlighted the following key challenges:

Technology. Views on the maturity of technology vary across the industry. Some argue that the current generation of devices need modification whereas others argue that transformational change will be needed to produce cost effective marine energy. Either way, there is consensus that the technology still presents significant risk. The engineering challenges associated with deploying devices in highly energetic seas have proved problematic. OpenHydro and Pelamis both experienced significant difficulties before achieving grid connection. Secondly, the price of raw materials, including steel and subsea components, has been prohibitive.

Funding. The marine energy industry is at a crucial stage; technology is being tested in the real ocean environment. Extra capital funding is required to ensure that a sufficient range of well-engineered technology can be tested. There is funding for both renewables and marine energy available but much of it over-estimates where the marine sector is. For example, funding from the Research Councils and Technology Strategy Board targets applied research and development – the marine sector is ahead of this. However, the next tranche of funding, available from the Environmental Transformation Fund, is the Marine Renewables Development Fund (MRDF). Despite being praised by the industry, no developer has yet been able to meet the funds stringent entry criteria. There is potential for some of the more advanced technologies to benefit from the fund in the future as they further develop, and funding from the Energy Technologies Institute is helping to develop a 1MW tidal turbine project in Orkney to achieve MRDF eligibility. With this one exception, though, consultation with the industry suggests that a funding gap exists between applied research and development and pre-commercial deployment. Filling this gap will allow more technologies to be designed, manufactured and tested in the real ocean environment and therefore help secure the future of marine energy.

Skills. The UK has little experience of installation, operation and recovery in high-energy tidal waters. Given our North Sea oil and gas experience, we do however have significant marine operations and subsea experience, which could help address the technical risks of deploying devices at sea. Attracting as much of these skills as possible to the marine energy industry will be vital to its collective success.

Grid Capacity in areas of significant potential for marine energy is limited. Indeed, according to many developers the grid will be the number one constraint to marine energy. Unless this is solved, developers may be forced to move to countries where grid barriers do not exist.

MAKING MARINE A REALITY

Overcoming the aforementioned challenges will be central to ensuring marine energy delivers on its potential. In order to do so, IMechE has developed the following recommendations directed to the Scottish Government (although their relevance extends to Westminster as well):

1. **Scotland maintains momentum through strong, courageous and consistent political leadership**. Developing a world-leading marine energy enterprise is a long game and sustained support, consistency and foresight are required. All agree that the political will and cross-party support for the industry over the past few years catalysed the considerable progress achieved and have contributed to a sense of belief. This needs to be developed in step with the emerging needs of the industry. Political leadership needs to be evident in rhetoric, action, engagement and foresight.

   The benefits of action to date can be seen through the progress achieved by funding and the EMEC facility. It is essential that this continues. Energy utilities and technology developers are engaged with the opportunity, but involvement from Scotland's subsea, marine and manufacturing base is limited and not characterised by the same sense of belief. With the enterprise moving into a phase of subsea design, manufacture and installation, this needs to be addressed. Foresight: a realistic projection of the future skills and infrastructure required to deliver the competing global demands of marine energy, offshore wind and oil & gas needs to be made and acted on.
2. **Scotland provide further capital support**, targeted at providing the requisite skills to overcome current technology challenges. The marine energy enterprise is at a crucial stage where the technology is being tested in the real ocean environment. Extra capital funding is required to ensure that a sufficient range of well-engineered technology is tested. Initial analysis suggests that the size of such a scheme would be £40m of public funds, supporting of the order of 4 projects, each advancing different technologies. Such a scheme would complement the Saltire Prize, by providing bankable support playing to the strengths of Scotland's existing enterprise (whilst the Saltire Prize acts to advocate these strengths on the global stage).
3. **Work with Westminster to find common infrastructure solutions**. Collaborative working between the Westminster and Holyrood administrations is required to find win-win solutions. Westminster's renewable energy strategy[4] does not foresee a significant role for marine energy by 2020, but Holyrood does. However, the UK is likely to rely heavily on Scotland to meet its 2020 15% renewable energy target and hence a significant portion of the infrastructure investment is likely to fall in Scotland. It is recommended that Scotland's contribution to the UK's 2020 renewable energy target is defined and a commensurate proportion of transmission system infrastructure investment devolved. It would then be for Holyrood to agree the nature of that investment to support its vision of how Scotland will achieve its contribution to the UK target.

REFERENCES

1 BERR Consultation Document, UK Renewable Energy Strategy, June 2008
Available at http://renewableconsultation.berr.gov.uk/consultation/consultation_summary

2 Ibid.

3 Scottish Government News Release
www.scotland.gov.uk/Topics/Business-Industry/Energy/saltire-prize

4 BERR Consultation Document, UK Renewable Energy Strategy, June 2008
Available at http://renewableconsultation.berr.gov.uk/consultation/consultation_summary

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