

Ladies and Gentlemen

Many of you probably believe that marine renewable energy began sometime in the 1970s and was associated with, or example, the Salter Duck, which was invented by my predecessor at the University of Edinburgh, Professor (now emeritus) Stephen Salter.

Certainly I believe that the work done by Stephen and others at organisations such as Bristol University, The University of Lancaster and the National Engineering Laboratory, to name just three, was pivotal in our thinking about energy from the sea. This work, however, lagged far behind the original pioneers of marine energy.

Tidemills, such as that at Eling, were in use in Roman time and many were mentioned in the Domesday Book! The names of these pioneering developers have been lost in history along with the inventors of the wheel and other true seminal achievements.

Tidemill technology was in use in the South of England right up till the twentieth century and the Eling Mill only became non operational due to the shortage of skilled staff resulting from conscription and consequential deaths in the first world war. It has now been restored to operational status and I thoroughly recommend a visit.

More recently, tidal barrages have been operating in Northern France at la Rance, which was constructed in the 1960s and in Canada at Annapolis Royale in Nova Scotia since the 1980s.

The extraction of energy from tidal currents, as opposed to tidal rise and fall has been considered, in principle, for centuries but it was only in the 1970s, with the publication of seminal papers by Cave and Evans that serious consideration began.

In the early 1990s a series of pivotal experiments were conducted by Peter Fraenkel, then of IT Power Ltd and now of MCT Ltd, which demonstrated in a sea loch in the west of Scotland that it was possible to extract energy from tidal currents.

Interestingly the work was part funded by Scottish Nuclear and represented an early demonstration of “All Energy” thinking. Since then MCT, in particular, have led the pioneering development of tidal current power and I am proud to share this platform with Martin Wright today.

The history of wave power is perhaps not quite so long as tidal but the “Wright Wave Motor”, a precursor of modern oscillating wave column devices was operating off Manhattan Beach in 1897!

There are French patents for even earlier wave devices involving shore mounted levers attached to moored boats being used to drive mechanical systems. There is, however, no evidence that these were ever built.

Japan had a vigorous wave power development programme in the aftermath of the Second World War. Stimulated, no doubt, by the nation’s dependence on imported energy, something this country, and most of the developed world, needs to consider! A large floating wave device, Kaimei was operational in the 1970s and the Mighty Whale, its spiritual successor was launched in 1998.

Many nations, including the UK, Japan, Denmark, USA, Sweden, France, Germany, India and others now have active wave development programmes and the testing of prototype devices is ongoing in many of these.

In the UK there are many exciting marine renewable developments and Martin I am sure will cover at least one of these! SeaFlow, the prototype tidal current systems operated by MCT in the Bristol Channel now been demonstrated to work.

Pelamis, the offshore wave device developed by OPD Ltd, and had its earliest origins at the University of Edinburgh, has been demonstrated at the European Marine Energy Centre in Orkney and presently three commercial devices are awaiting installation off the Portuguese coast.

The Limpet device, developed by Wavegen Ltd, has been operating in the Inner Hebrides since 2000 and, like its experimental predecessor, has demonstrated the effectiveness of coastal wave energy extraction.

The European Marine Energy Centre (EMEC) has been established in Orkney to allow the systematic assessment of prototype wave and tidal current devices. In effect this offers the potential for certified “type testing”, necessary if the industry is to move further towards commercial standing.

The work of decades, or even millennia, has demonstrated that wave and tidal energy can be effectively harnessed. In many ways, however, we are at a crucial phase in the development of a new industry.

Perhaps the best analogy is aviation at the time of the Wright brothers. We now have working metal in the water. The first steps have been made towards commercial development. There are, however, still questions to which answers need to be made available. I am choosing my words carefully there! In many cases the answers are known but not being observed by those who need to see them.

Let us consider just some of the issues:

Is there enough energy out there to make the effort worthwhile?

The most recent and reliable assessment of the UK achievable wave resource suggested a readily harnessable resource, in Scotland alone, equivalent to almost 50TWhrs of electricity generated annually. This is equivalent to some 16GW of installed capacity. The assessment, conducted by Garrad Hassan, took into account environmental constraints and the prospect for economical competitiveness.

A publication by the Carbon Trust suggested that the UK tidal current resource is somewhat smaller, of the order of 16TWhrs/annum. This was published, however, before the development of more sophisticated understanding of the tidal environment and a reassessment suggests that the accessible resource UK wide is more likely to be of the order of 60TWhrs. This is smaller than wave but the most energetic sites are relatively compact offering the prospects of physically smaller developments, which must be to the benefits of economics.

The UK possesses good, but not unique marine resources, so the prospects for technology export to nations such as the USA and Canada and to the Far East look enticing.

Can the resource be developed in an environmentally acceptable manner?

Objections such as wave power plants distorting the wave climate, resulting in consequent and unpredictable coastal changes are sometimes raised. Let's put this

in context. With careful planning, operation and location, wave climate distortion can be kept to within acceptable limits.

Wave power developments may even be able to protect vulnerable coastlines. We know enough about the behaviour of waves and sediments to achieve this. If we want to ban anything, the development of coastal golf courses in the UK, especially Scotland, has done more to destroy the natural on-offshore movement of sediment than anything else. I am not aware of a pressure group dedicated to protecting the coastal morphology from golf!

There has been talk of tidal current devices killing seals and dolphins! Mathematical analysis has demonstrated that, with appropriate device design and location, this too can be a non issue.

I can certainly sit down and design a tidal system which would be devastating to sea life but no responsible developer would ever seriously consider it. Similarly I could design a car which would mow down pedestrians. But then so can the motor industry!

The marine renewable industry has been scrupulous in its attention to environmental and social impact. I wish all industries were so ethical.

Like Martin Wright, I have strong opinions on the so called precautionary principle. This says that if you cannot prove that a development will do no harm, then it must not be done!

Gaps in scientific understanding will, therefore, prevent any development! The precautionary principle could be used, and perhaps has been used, to hinder even experimental developments.

Consider a hypothetical case: I wish to install a wave power device in a particular location. I have conducted theoretical and laboratory studies which demonstrate that there will be no unacceptable environmental impact.

The objection is based on the fact that there are no full scale measurements to support the theory! It's Catch 22! How can I get the full scale measurements without deploying the device?

Let us restate the precautionary principle. Instead of saying "let us take no action if we cannot prove that there will be no detrimental consequences", which must be a recipe for stagnation, let us adopt a universal approach: "let us ensure that due cognisance is taken of the benefit of development as well as making reasonable assessments of any risk".

After all, every time I drive to work, I cannot guarantee with 100% certainty that I will not expire in a nasty multi vehicle pile up! Yet I know that the benefit, in the form of access to income for my family, is worth any risk! I suggest you all read the works of Jeremy Bentham, especially "An Introduction to the Principles of Morals and Legislation", or even more poignant, "The Handbook of Political Fallacies".

I have even heard an objection to tidal current energy, and I quote "because it might hinder the development of a future leisure submarine industry".

Ladies and gentlemen, I am proud of the contribution my institution has made to the evolution of the marine renewable industry. In the 1970s and 1980s, Stephen Salter

and his team pioneered the then infant science of wave model testing, which now sits at the core of wave device development.

Now, through our involvement with industry, the research councils and other institutions through the Supergen (marine) research consortium, we are at the forefront of fundamental research intended to close the gaps in understanding, which might otherwise hinder the future development of the industry: We can now predict with confidence the marine resource; we know how to effectively test model tidal turbines; we have new control systems which can maximise energy extraction from wave devices, whilst minimising mooring loads.

Supergen (marine) will run for another five years but the industry does not need to await all of our results. We are answering the questions for the industry in five years and longer. Remember the Wright brothers' analogy. We have the Wright Flyer; a lot of further research was needed to support the development of the Airbus A380 but that was not an argument to delay the development of the Boeing 707!