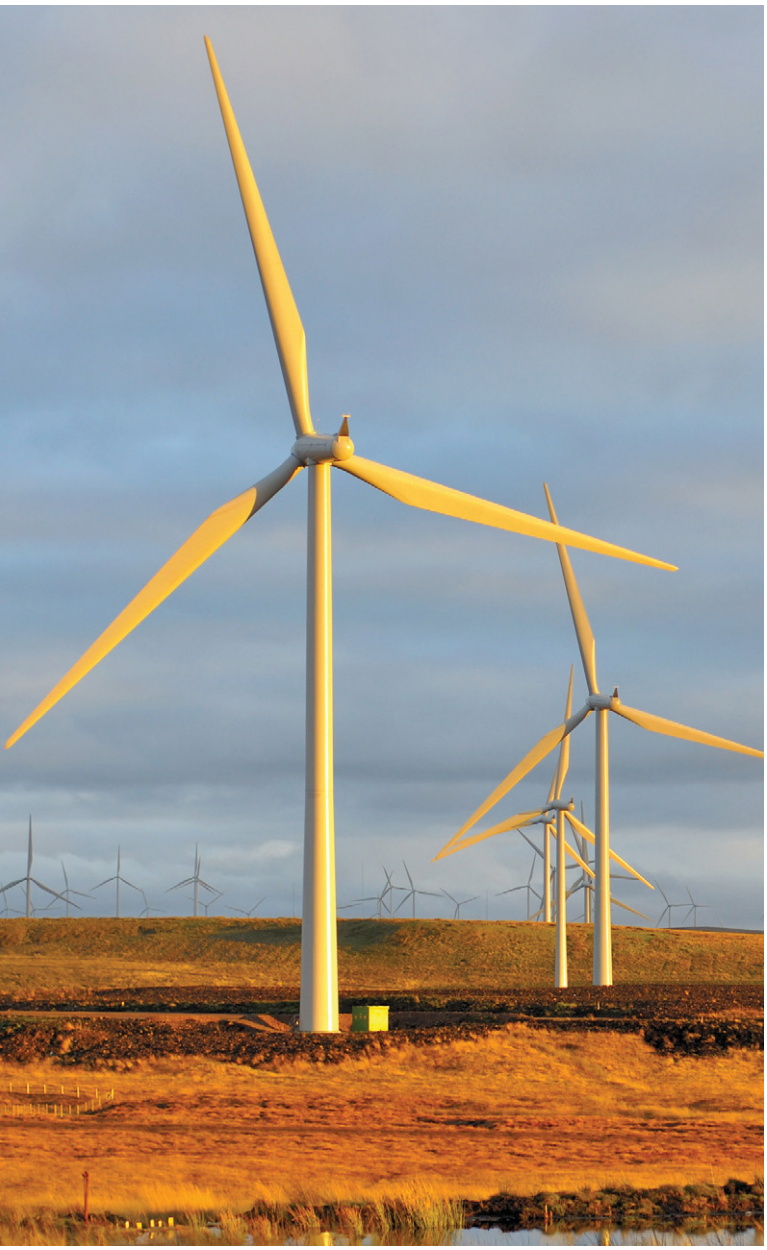
Renewable energy in Scotland

AN EXCELLENT WIND RESOURCE, POWERFUL COASTLINES AND A WEALTH OF WOODLAND GIVE SCOTLAND AN UNDENIABLE ADVANTAGE IN THE RENEWABLE ENERGY RACE. AND SCOTLAND'S POLITICIANS APPEAR KEEN ON USING THIS CLEAN ENERGY POTENTIAL AS A MAJOR TOOL TO DRIVE ECONOMIC DEVELOPMENT. **DERRY ALLDRITT** AND **DAVID HOPWOOD** REPORT.



Europe's largest onshore wind farm at sunset, Eaglesham Moor, Scotland.

In recent decades the oil resource in the North Sea has been pivotal in boosting Scotland's economy. But this is slowly changing, and many energy experts believe Scotland's key carbon resources – which are also crucial to the rest of the UK – are on the wane.

According to a recent report by the **UK Industry Taskforce on Peak Oil and Energy Security**, the UK became a net importer of oil at the beginning of 2006, shortly before the peak in global oil production – in fact oil production from the North Sea (west of Shetland), peaked in 1999, and has since fallen from 137 million tonnes to 72 million tonnes. The report also speculates that this oil field will effectively run out by "about 2020".

This will clearly have a major effect on the UK's balance of payments, not to mention loss of income from North Sea oil, and a drop in oil-related jobs. And this effect is sure to be highlighted especially in Scotland.

"For the UK, 'peak oil' is no longer a matter of theoretical debate," claims Dr Robert Falkner at the **London School of Economics**, writing in the above-mentioned report: "Ever since oil production in the North Sea started to decline just over a decade ago, the prospect of continuously dwindling petroleum reserves has become part of the country's new economic reality…and as the UK is becoming more dependent on energy imports, the parameters of energy policy are shifting."

Scotland is well placed to take advantage of this shift in energy policy, and one of the most prominent politicians in Scotland, **Scottish National Party** leader Alex Salmond, has gone on record to say he wants the country to "lead the world in renewable energy".

A new energy economy for Scotland in wind and marine

Onshore and offshore wind

When it comes to renewable energy resources, the jewel in Scotland's crown would arguably be wind power, and the ferocious winds that sweep over the glens and braes of the highlands make the Scottish countryside an ideal haven for wind turbines.

Of the (approximately) 170 renewable sites in Scotland, 56 of these are large wind farms, and there are currently proposals to build Europe's largest

onshore wind farm on the island of Shetland. Though the plans are at an early stage and the project would not be up and running before 2016, **Viking Energy** – the joint venture between the Shetland community and **Scottish and Southern Energy (SSE)** – plans to create an array of 150, 3.6 MW turbines (0.5 GW total capacity) across Shetland. Viking claims that these turbines would produce 2 billion units of power every year, enough to supply 20% of Scotland's overall domestic energy requirements.

As well as the potential for onshore wind in remote areas of Scotland, the **offshore wind sector** has received a recent boost too.

Two of the UK's *Round 3* offshore wind development proposals are in Scotland – the *Moray Firth* and *Firth of Forth* (*see box – Round 3 Scottish offshore wind development*). These two wind farms alone have the potential to provide 950 new wind turbines and generate 5 GW of electricity. This would transform Scotland's offshore wind generation capacity, which currently stands at roughly 190 MW.

In addition to the Round 3 developments, four additional zones (with a combined capacity of some 2470 MW and part of the **Scottish Territorial Waters** development sites immediately inshore of the Firth of Forth zone) have been announced. Award of consent for the individual projects could be granted as early as mid-2012 by the Scottish Government:

- *Inch Cape*, a 905 MW project, awarded to **RWE Npower Renewables** and **SeaEnergy Renewables** (Inch Cape Offshore Wind Farm);
- *Bell Rock*, 700 MW, **Airtricity Holdings UK** and **Fluor**;
- *Neart na Gaoithe*, 450 MW, **Mainstream Renewable Power**; and
- *Forth Array*, 415 MW, **Fred Olsen Renewables**.

The four companies have formed a working group to ensure that, subject to the outcome of a *Strategic Environmental Assessment* currently underway, their respective offshore wind farm proposals are developed in a manner that is "coordinated and sensitive to the environmental and socio-economic features of the Scottish east coast".

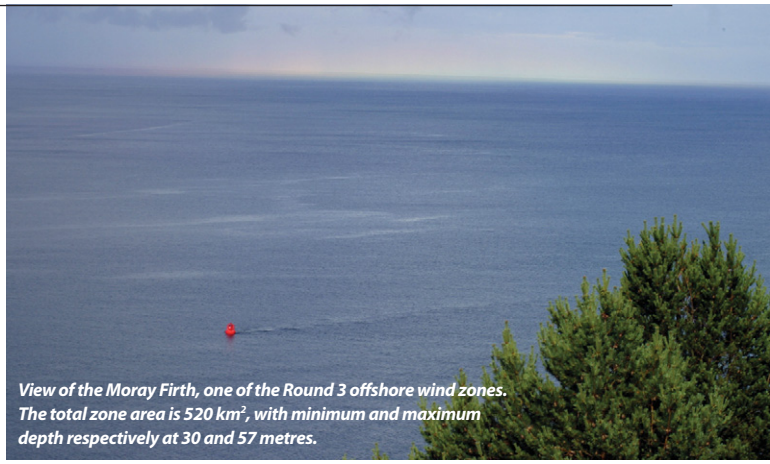
Round 3 Scottish offshore wind development

1. Moray Firth zone, **Moray Offshore Renewables Ltd** which is 75% owned by EDP Renovaveis and 25% owned by SeaEnergy Renewables.

- Potential capacity 1.3 GW;
- The total zone area is 520 km^2, with minimum and maximum depth respectively at 30 and 57 metres;

2. Firth of Forth zone, **SeaGreen Wind Energy Ltd** equally owned by SSE Renewables and Fluor.

- Potential capacity 3.5 GW;
- The proposed capacity is almost double Scotland's existing renewable generation capacity;
- The total zone area is 2852 km^2 – only a fraction of which will be developed – which is approximately twice the size of the Kingdom of Fife or ten times the size of the city of Edinburgh;
- The mean water depth of the zone is 50 m and ranges between 30 and 80 m; and
- There are four Scottish Territorial Waters development sites immediately inshore of the zone; Bell Rock (SSE Renewables and Fluor), Inch Cape (RWE and SeaEnergy), Neart na Gaoithe (Mainstream) and Forth Array (Fred Olsen Renewables).



View of the Moray Firth, one of the Round 3 offshore wind zones. The total zone area is 520 km^2, with minimum and maximum depth respectively at 30 and 57 metres.

Marine Power

When it comes to wave and tidal energy, Scottish players believe they have a world-leading resource to exploit. Something they are now beginning to do in earnest.

As recently as March 2010, 1.2 GW of wave and tidal development across 10 sites in Scotland's **Pentland Firth** and **Orkney** waters was announced in the **Crown Estate's** first wave and tidal energy leasing round – a world first in wave and tidal.

The proposed 1.2 GW of wave and tidal is expected to be ready for 2020 with 600 MW each for wave and tidal (*see box – marine development in Scotland*).

Wave developers chosen include **SSE Renewables Development Ltd** (200 MW for *Costa Head* site); **Aquamarine Power Ltd** & **SSE Renewables Developments Ltd** (200 MW for *Brough Head* site); **ScottishPower Renewables UK Ltd** (50 MW for *Marwick Head* site); **E.ON** (50 MW for *West Orkney South* site); **E.ON** (50 MW for *West Orkney Middle South* site); **Pelamis Wave Power Ltd** (50 MW for *Armadale* site).

Tidal developers chosen include **SSE Renewables Development (UK) Ltd** (200 MW for *Westray South* site); **SSE Renewables Holdings (UK) Ltd** & **OpenHydro Site Development Ltd** (200 MW for *Cantick Head* site); **Marine Current Turbines Ltd (MCT)** (100 MW for *Brough Ness* site); **ScottishPower Renewables UK Ltd** (100 MW for *Ness of Duncansby* site).

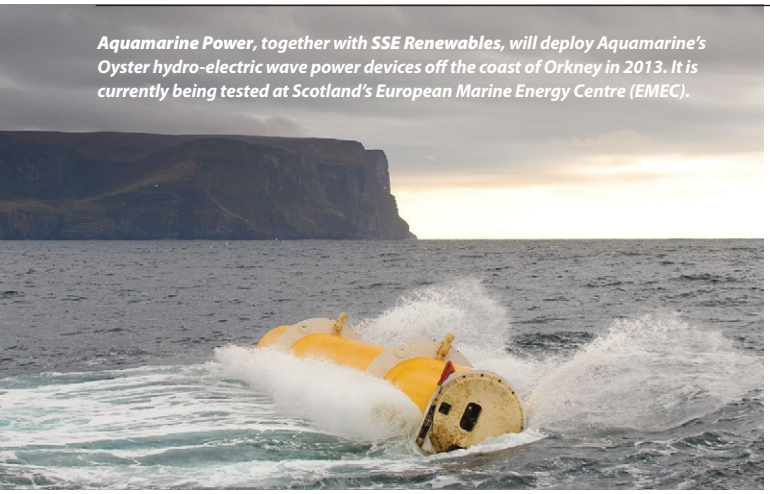
In addition, the UK Crown Estate is inviting expressions of interest for a further tidal energy project in the *Inner Sound* between Caithness on the Scottish mainland and the island of Stroma.

As one of the most energetic tidal areas in the Pentland Firth, the Inner Sound has potential for a significant commercial tidal energy project, according to the Crown Estate. Such a tidal energy project could increase the potential capacity in the Pentland Firth and Orkney waters to more than 1200 MW.

The Crown Estate received bids for development in the Inner Sound as part of the leasing round above, but the preferred bidder withdrew at a late stage in the process; the Crown Estate has therefore now decided to re-tender the project.

Growing the renewable economy

As well as tackling climate change and energy security issues, Scottish politicians are throwing their weight behind renewable energy development as an economic driver to offset the shrinking oil industry.



Aquamarine Power, together with SSE Renewables, will deploy Aquamarine's Oyster hydro-electric wave power devices off the coast of Orkney in 2013. It is currently being tested at Scotland's European Marine Energy Centre (EMEC).

There is currently 6.5 GW of renewables capacity installed or in development in Scotland, but plenty of scope to increase this – Scotland has also set itself tough targets, going beyond those mandated by Whitehall and the EU, aiming for 50% of its electricity to be supplied from renewable resources by 2020, with an interim milestone of 31% by 2011.

Another crucial energy target Scotland must meet is to ensure that 11% of the demand for heat is met from renewable resources by 2020. Vast amounts of uncultivated land make it potentially feasible to increase the role that bioenergy plays in meeting Scotland's heat energy target (unfortunately beyond the scope of this article).

Achieving these milestones – and hence delivering a successful renewable energy industry in the process – would bring many advantages to the Scottish economy and job market. Scottish Minister for Energy, Jim Mather, believes that harnessing the energy related – opportunities presented by Scotland's environment could create "at least 16,000 jobs over the next decade."

Scottish manufacturers could therefore benefit by supplying the renewables market, and service companies could reap potential rewards by maintaining it.

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Martin Wright, of **Marine Current Turbines (MCT)**, active in developing tidal energy projects in Scotland, says MCT will look to companies in the Orkneys and Caithness to support the tidal project: "We recognise that the local supply chain could provide us with valuable expertise, not least in marine and port services, and in engineering and fabrication. We are very keen to work with local companies and the local agencies so that they can share in these exciting opportunities," he says.

Any such increase in job creation would be greatly welcomed in Scotland after figures released earlier in 2010 showed that unemployment had risen by 9.4%.

A range of different renewable technologies would allow different parts of Scotland to benefit from economic development. **Scottish Renewables** director of policy, Jenny Hogan adds, "we very much need a portfolio of renewables to meet the targets and garner the economic benefits."

In order to try and maximise the benefits derived as part of these economic benefits, Scotland recently published a study outlining how it wants to capitalise on its substantial offshore wind and tidal resources, and develop a sustainable and long term industry for the future.

The report – *Scotland's National Renewable Infrastructure Plan* – identified a range of sites which offer the potential to help Scotland become an established location for offshore wind turbine manufacturing and construc-

Marine development in Scotland – selected projects

■ Aquamarine Power

Aquamarine Power, together with SSE Renewables, will deploy Aquamarine's *Oyster* hydro-electric wave power devices off the coast of Orkney in 2013. The wave power devices will be deployed in small clusters off mainland Orkney running from Costa Head in the north to Neban Point in the southwest.

The proposed wave farm is expected to have an installed capacity of 200 MW.

Martin McAdam, of Aquamarine, says: "The Crown Estate's leasing round is a significant milestone for the marine energy sector and is a key step towards the industry's commercialisation, enabling it to meet its full potential to deliver clean sustainable power as well as highly skilled long-term employment."

■ Marine Current Turbines

Marine Current Turbines Ltd (MCT) will deploy its *SeaGen* tidal current device off Brough Ness, the southernmost tip of the Orkney Islands and north east of John O'Groats.

MCT is aiming to secure planning and environment consents by 2015 with construction starting in 2016. The first tidal turbines could be deployed during 2017, with the whole scheme in operation by 2020.

The plan is to install 66 *SeaGen* tidal turbines with a capacity of 99 MW in total over a four year period across an area of 4.3 km^2. However, Marine Current Turbines says that the timing of construction and deployment will be dependent on the local grid infrastructure being strengthened.

Martin Wright, Managing Director of Marine Current Turbines, says: "The Pentland Firth and Orkney waters are strategically the most important marine energy areas in Western Europe so we are delighted to have secured approval for a lease by The Crown Estate."

■ Pelamis Wave Power Ltd

Pelamis (PWP) is to develop a 50 MW wave project with E.ON UK off the coast of the Orkney Islands, and a 50 MW wave project with ScottishPower Renewables, also off the coast of the Orkney Islands.

Neels Kriek, CEO at Pelamis Wave Power, says: "The Crown Estate's process has set our industry on course towards delivering marine projects of utility scale."

The first full-scale Pelamis wave device prototype was installed at the **European Marine Energy Centre (EMEC)** in Orkney between 2004 and 2007. Pelamis is currently in the final stages of building the first *Pelamis P2* wave energy machine for E.ON, which is due to be installed at EMEC this summer.

tion operations. And it highlights that investment in a number of key locations over the next five years is key to growing a globally competitive renewable energy sector in Scotland, and to ensure other parts of the country can benefit in the longer term (some of the sites that have been identified as potential locations for a first phase of staged investment include Dundee, Nigg, Energy Park Fife at Methil, Aberdeen, Kishorn and Peterhead).

As a result of such activity, a number of companies are anticipating a surge in renewable energy development, and have begun to set up operations in Scotland.

Global engineering consultancy, **Pöyry**, for example, is launching a dedicated renewables team to be based in Aberdeen.

With its capability in biomass, wind, solar and hydro power, the global engineering consultancy has been involved in projects around the world and believes North East Scotland is the ideal location to expand its renewables offering in the UK.

Dr Christian Tribbe, Renewables Leader in Aberdeen says: "Pöyry has been active in the UK in hydro, biomass and waste-to-energy for many years, and the time is now right for us to build our UK services which will primarily focus on wind and marine energy. Our wind power track record is established throughout Europe, and our Aberdeen teams bring offshore expertise to complement that capability.

"There has been a great deal of debate in the oil and gas industry about how skills can be transferred to the renewables sector. There is no doubt that oil and gas experience can and should be used to benefit the offshore renewables sector."

"The Pentland Firth and Orkney waters are strategically the most important marine energy areas in Western Europe so we are delighted to have secured approval for a lease by The Crown Estate."

– Martin Wright, Managing Director of Marine Current Turbines

The company has worked within the renewables sector for more than 20 years, being involved in landmark projects both in Scotland and around the world. It delivered the detailed design and construction support for the *Glendoe* hydropower scheme near Fort Augustus in the Scottish Highlands.

The barriers to renewables development in Scotland

Local opposition

Despite the compelling arguments for renewables development, there are of course major stumbling blocks that will need to be overcome.

The Scottish, understandably, love their countryside, and many argue that wind power is inefficient, unreliable and unsightly. An increasingly vocal minority make their voices heard.

RES UK and Ireland secures financing deal for Hill of Towie wind farm

Renewable energy developer **RES UK and Ireland** has secured financing for its *Hill of Towie Wind Farm*, in Moray (Scotland). The arrangement with **Lloyds Banking Group** and **BNP Paribas** for construction of the wind farm is the first large scale project to benefit from the **European Investment Bank (EIB)** *Intermediated UK Onshore Wind Scheme*.

The banks have established a *Portfolio* facility to support the company as it seeks to develop and own a pipeline of up to 300 MW of wind farm projects in the UK and France over the next three years. Further projects are expected to be added to the portfolio throughout the course of 2010. The total long term project finance facilities for Hill of Towie were £76m, with a debt tenor of 17 years. Lloyds Banking Group will act as *Agent Bank* to the Portfolio and BNP Paribas as *Issuing Bank*.

Hill of Towie Wind Farm, at 48MW, will be RES's largest onshore project in the UK to date. The project will be constructed and owned by RES, using **I&H Brown Limited** of Perth to undertake all the civil and ancillary works. The project will use 21 **Siemens** 2.3MW wind turbines, which are due to be delivered in summer 2011, and the power will be purchased by **Scottish Power**.

Hill of Towie Wind Farm is expected to be fully commissioned by spring 2012, following the **National Grid**'s queue advancement process, which saw the grid connection date brought forward from 2018. Once operational, Hill of Towie could make a significant contribution to Scotland's ambitious renewable energy targets.

One example is the large number of Shetland residents who have opposed the Viking Energy proposal (mentioned earlier in this article) and a campaign group – **Sustainable Shetland** – has been set up to try and stop the plans going ahead.

But people like Gordon MacDougall, Chief Operating Officer of **RES UK and Ireland** thinks this problem is possible to overcome: "I think Scotland as a whole has got a mature viewpoint [on wind power], and I think what you tend to see is less fear of the unknown than in some other countries. Also, councils (and certainly the Scottish Government) have a very strong commitment to renewables, and their approach to consenting is quite positive".

He adds that RES' approach is to work with communities to find a solution, and try and appeal beyond what he sees as "a vocal minority that can be very small, but often well funded", to the wider community.

Jenny Hogan of Scottish Renewables believes the problem can be solved by helping adults welcome changes by educating them on renewable energy; "the schools are beginning to help young people understand the need for sustainable energy, but there is more that could be done to change the hearts and minds of adults."

Planning and grid issues

Aside from local objection, other well documented problems the renewables industry often faces is the availability (or lack) of national grid connections, as well as planning, though MacDougall concedes that since the upsurge in renewables development, "councils have been encouraged to be clearer and put in place planning guidelines", to speed up the decision making process.

The grid is still one of the greatest problems the industry must overcome, according to Martin McAdam, of Aquamarine Power: "The fact is that the biggest challenge for all renewables is getting grid connections. Once this grid issue is solved, then it's solved for all the industries. There's going to be a massive programme of offshore wind development in UK territorial waters. We see this as an opportunity for marine renewables to share the new grid infrastructure that's being put in place for offshore wind".

"Developers are already queuing up to exploit our offshore wind resource, with around £30bn set to be invested in Scottish waters".
– Jim Mather, Scottish Minister for Energy

At the start of the year it was reported that the **National Grid** would increase its rates, and the cost of putting power in the grid could be as much as three times more expensive. This could make renewable projects much more costly. To add to Scottish frustrations, electricity producers in Scotland pay higher rates for grid connections than producers in England.

According to RES' MacDougall, "if you want to connect to the national grid in Scotland, you'll pay significantly more than somebody connecting in England, and I think some of that regional discrepancy is unfair and overly penalises potential Scottish projects".

In addition, the current grid may need to be expanded to cope with renewable energy needs, though this could actually be a long way off: "I think all the independent studies certainly suggest that there's an awful long way to go before that would become a problem," adds MacDougall, "and even then there's a number of measures that can be taken to manage that load better as we move towards a smarter grid".

A framework has been put in place to provide more capacity, which will help Scotland realise its renewables potential. There are 8 upgrades set to take place, including the strengthening of the Scotland-England interconnector to a capacity of 3.2 GW, and a new sub-sea cable link for the Outer Hebrides and Shetland Islands.

But beware. The recent planning saga concerning the *Beauly–Denny* power line has shown how difficult it can be to get developments approved by planning authorities. The application, first made in 2005 has only just been passed after a series of objections.

Another issue to be addressed is funding, a subject that could fill a separate article. Suffice to say that with the Government under pressure to meet targets and keeping the taxpayer happy, funding needs to be used sensibly, with more money going to the technologies that need it most.

With a range of different renewables the Government must have a careful selection process when choosing areas to fund. Scottish Minister for Energy, Jim Mather, explains: "Offshore wind, marine energy and renewable heat are a key focus due to the potential to generate clean energy, reduce emissions and the associated manufacturing and infrastructure opportunities. That is why developers are already queuing up to exploit our offshore wind resource, with around £30bn set to be invested in Scottish waters".