Nuclear Free Local Authorities
briefing

Date: 7th July 2010 **No.76**

Subject: **Scotland's electricity needs – can they be met from renewables without recourse to nuclear?**

1. Purpose of this briefing

This briefing has been developed by the NFLA Scotland Policy Advisor, Pete Roche. It has been developed after requests by NFLA Scotland member councils and other NGOs to consider the areas where renewable energy in Scotland can be promoted as an eventual alternative to fossil fuels and nuclear power. The report suggests that Scotland, with sufficient political will from the current and future Scottish Governments, supported by Scottish local authorities; can eventually produce 100% of its electricity requirements from renewable sources. The NFLA plans to undertake similar studies for England, Wales, Northern Ireland and the Republic of Ireland in the near future.

2. Introduction

It has been clear for a while that Scotland is well placed to meet 100% of its electricity requirements from renewables in the not too distant future. (1) A paper by Scottish Natural Heritage (SNH) last November suggested this might be relatively easy. (2)

The Scottish Government's target is to produce 50% of Scotland's electricity from renewables by 2020 - around 8,000MW (8GW). There is already an installed renewable capacity of around 2834MW, plus 3739MW with planning permission but not yet built, bringing the total to 6573MW.

A further 9,000MW is awaiting planning consent, with an additional 8,500MW of offshore wind and between 500MW and 2,000MW of marine renewables under development and scheduled for completion by 2020. Thus, says SNH, Scotland can easily meet its 2020 target, and could even meet 100% of its electricity requirements.

3. Offshore Wind in Scotland

A few years ago there was hardly any mention of offshore wind in Scotland. Apart from the Solway Firth, waters around the Scottish coasts were thought to be too deep. Now offshore wind in Scotland is recognised as having a huge potential in depths greater than 50 metres. Scotland was ignored in Round 2 of the Crown Estate's site allocation process, but then received a huge 6.4GW of potential capacity in February 2009 through the Scottish Territorial Waters (STW) Round, (3) which covers waters out to 12 nautical miles.

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In January 2010 the Crown Estates announced it was granting rights for the biggest expansion in offshore wind seen so far. (4) The so-called Round 3 granted rights to energy companies for nine offshore areas, including the Firth of Forth and the Moray Firth, with around 850 turbines being built across the two Scottish areas with a combined capacity of 4.8 gigawatts (GW). (5) When combined with the 6.4GW in the STW this brings the total to more than 11GW capacity, which is 2.5GW more than the SNH estimate.

Scottish Renewables - 8,000 MW = 50% target for 2020

Already installed (Nov 2009)	**2834 MW**
With Planning Permission	**3739MW**
Awaiting consent	**9000 MW**
Offshore Wind under development	**11000MW**
Wave and tidal by 2020	**up to 2000 MW**
Total	**28773 MW = 179%**

In May 2010 the Scottish Government earmarked 25 new potential sites for offshore wind development after 2020. The locations were revealed in the Strategic Environmental Assessment and Development Plan for Offshore Wind, which was published for consultation. (6)

4. Wave Power in Scotland

Scotland's total potential renewable capacity is thought to be at least 60GW. (7) Harnessing this will depend partly on developing wave and tidal capacity as well as offshore wind. The Crown Estate awarded an unprecedented 1.2GW of wave and tidal energy project leases in March 2010 consisting of six wave energy projects totalling 600MW and four tidal projects amounting to 600MW in the Pentland Firth and Orkney Waters Strategic Area leasing round. (8) The sites were awarded to a number of utilities and advanced technology developers including Marine Current Turbines, Pelamis Wave Power, SSE Renewables Developments – joining forces with Aquamarine and Open Hydro, Scottish Power Renewables and EON. In order to facilitate the transition from research and development to scaling up and delivery, and in response to the Government's Marine Energy Action Plan, the trade body, Renewable UK published a document entitled "*The Next Steps for Marine Energy*" which maps out how the industry can achieve a target of 2GW by 2020. (9) The Crown Estate announcement heralds the "dawn of a new era" because Scotland has the potential to become a world-leader in the fledgling industry, which has huge potential for growth. The stretch of sea between Caithness and Orkney is the first around the UK to be opened up for the development of marine renewables and almost 40 companies applied for leases. (10)

The Scotsman described marine energy as a windfall within Scotland's grasp which could power the country seven times over by 2050, (11) after a study undertaken by the Boston Consulting Group for the Offshore Valuation Group was published. (12) Currently the lion's share of renewable capacity is allocated to fixed wind turbines, with small amounts allocated to tidal stream and wave power. The study predicts that floating wind turbines have the most potential, possibly being able to generate 1,533 terawatt hours a year; 2,100 terawatt hours would have been enough to power the UK six times over in 2009.

The world's largest wave power device was switched on to the national grid in Orkney in November 2009. The Oyster machine marked a "key milestone" in renewable energy - with three linked devices contributing up to 2MW of power by 2011. The Oyster was developed by Edinburgh-based Aquamarine Power's researchers at Queen's University, Belfast. (13) In May 2010 a new prototype wave power machine which can produce 750kW was unveiled. The Vagr Atferd was manufactured by the Leith-based firm Pelamis Wave Power (PWP) for E.On. The device's development and construction was part funded by the Carbon Trust. It will be

transported to Orkney, where it will be tested for three years to prepare it for commercial use. (14)

5. Possible tidal power projects for Scotland

Sheffield-based company Pulse Tidal aims to have the “world’s first” tidal station producing 1.2MW of renewable electricity in 2012 and has begun a year-long environmental study ahead of applying to Marine Scotland for a licence. It is looking at the straits between the Isle of Skye and the Scottish mainland for its site. The company must apply for planning permission from the Highland Council to build its first commercial generator at the site: Pulse successfully tested a trial device in the Humber estuary in Yorkshire and the company received an eight million euro (£6.8M) EU grant to develop its first commercial generator. (15)

6. Fuel poverty – a major problem across Scotland

The Scottish Government is required by the Housing (Scotland) Act 2001 to end fuel poverty, as far as is practicable, by 2016. The most recent figures from the Scottish House Condition Survey show that 618,000 households were living in fuel poverty in 2008, representing 27% of the total. (16)

At the same time, Ofgem has estimated that renewing infrastructure and meeting carbon targets is likely to require an investment of up to £200 billion which will mean significant increases in domestic energy bills of between 14% and 25% by 2020. (17) Clearly fuel poverty needs to be central to climate and energy policy. Without an integrated strategy for both there is a danger that climate policy will end up worsening the situation with regard to fuel poverty. There are concerns about the achievability of the 2016 target with numbers of those suffering still growing, so policies which focus on energy efficiency for the fuel poor, including insulation and appliances are necessary and urgent. (18)

If the Scottish Government is to meet its target to reduce carbon emissions by 80% by 2050, AND eliminate fuel poverty by 2016, it will need to implement a set of policies which can cut emissions from the domestic sector by 80% by 2050. Every house will need excellent insulation and some form of Low and Zero Carbon Technology – micro-generation or community heating schemes. This means carrying out installations in all of Scotland’s 2.5 million dwellings over the next 40 years or 62,500 dwellings every year between now and 2050. (19)

7. Energy Efficiency

Clearly the top priority needs to be energy efficiency in buildings, and in particular, measures to improve existing buildings. This can address climate change and fuel poverty simultaneously. In Germany, which aims to deliver a 3% improvements in energy efficiency across the economy every year, there is a programme designed to systematically upgrade the entire building stock to "contemporary standards" over a 20 year period. It is funded through soft loans provided by a federal agency. Borrowers are able to take out low interest loans for measures that help older properties reach new-build standard through refurbishment. Only pre-1984 dwellings are eligible for loans: as in the UK, that was the date when building codes first mandated energy-saving standards. (20)

To date most of the policy initiatives on low and zero carbon housing have focused on new housing. It is important that building standards continue to raise the efficiency standards of new buildings quickly because otherwise increases in the overall building stock will increase carbon emissions. And building standards needs to be properly monitored and enforced. The low-carbon buildings strategy outlined by the Scottish Government’s Sullivan report offers a good foundation. (21)

However, existing houses lack the same degree of policy ambition despite the fact that 85% of homes standing today will still be lived in by 2050. The NFLA believes urgent investment and

action is required to seize the cost effective energy savings which could be made in the domestic sector. A WWF Scotland report shows how Scotland's existing homes can be transformed into low carbon homes and emissions from the domestic sector cut by 80%. (22) A very broad range of physical measures needs to be employed in any retrofit strategy in order to make the required substantial improvements in the energy performance of existing housing. This will include much wider use of solid wall, external insulation for example. But the analysis for WWF shows that physical measures will need to be combined with consumer behaviour change, improved standards of domestic appliances, and there will need to be a significant introduction of low and zero carbon technologies including microgeneration. The WWF report also suggests making use of the Energy Performance Certificates system to further incentivise energy efficiency, by progressively raising the standard required for any house to be sold or let.

8. Micro-generation projects

The previous UK Government's Low Carbon Transition Plan only expected 2% of the 30% renewable target to come from small-scale renewables - whereas the solar PV industry alone expects to provide 12% across Europe. (23) *Building* Magazine, says these plans for onsite renewables will release less than one-third of the industry's potential capacity. (24) According to the Energy Saving Trust we could provide 30-40% of UK electricity demand with micro-generation projects by 2050, (25) implying a contribution of around 10% by 2020.

The difference between 2 and 10% would be enough to not require replacing our existing nuclear reactors with new ones. With some of the world's leading small wind companies based in Scotland, and with its universities leading the way in solar energy Scotland is well placed to lead the way on this. However, the Scottish Government's Energy Efficiency Plan - which would include plans for the introduction of smart meters and for kick-starting small-scale renewable and heat technologies - has been delayed for a number of years. Its original scheduled publication date was 2005, but it now won't appear until autumn 2010. (26)

9. Low Carbon Heat

Heat supply makes up around 50% of Scotland's final energy use, so there is a real need to tackle emissions from this sector too, as well as electricity and transport. The Scottish Government has set a target which requires 11% of the heat consumed in 2020 to come from renewable sources, compared with 1.4% currently. 31% of heat use is in the industrial sector, 51% in the domestic sector and 18% in the commercial sector. (27) The Scottish Renewable Heat Action Plan focuses on actions needed over the next two years to set Scotland on the right trajectory to meet the 2020 target. Unfortunately it needs to be read in conjunction with the delayed Energy Efficiency Action Plan to get a complete picture of plans for low carbon heat, because the Energy Efficiency Plan will consider the role of waste heat from non renewable sources for district heating.

An earlier energy efficiency consultation document (28) highlighted a number of successful Combined Heat and Power (CHP) district heating schemes in Scotland. Although these tend to be gas-fired, they are much more efficient than centralised electricity generation which wastes two thirds of the energy used. CHP schemes can achieve an efficiency of around 85% for the combined production of electricity and heat. (Once heat networks are established, CHP plants could be converted to biomass at a later date as biomass CHP technology develops.) Aberdeen, for example, already has three schemes run by Aberdeen Heat and Power Co Ltd – an independent, not-for-profit company established to develop and manage the CHP schemes: the Stockethill project supplies heat and hot water to 288 flats in 4 high rise blocks; the Hazlehead project supplies 4 high rise blocks, a Sheltered housing scheme, school and swimming pool; and the Seaton project supplies 503 flats in 6 high rise blocks.

There are also schemes in Clydebank (29) and Edinburgh University (30). In fact, in 2006 there were 87 good quality CHP schemes in Scotland generating over 3 GWh of electricity and 8 GWh of heat - 6% of power generated and 8% of heat used, mainly serving large process sites in the petrochemicals, chemicals and food sectors. (31)

A study by Pöyry Energy Consulting looked at industries across the UK which could generate as much electricity as 10 nuclear power stations and halve gas imports by installing or extending CHP plants. Two out of the nine sites studies are in Scotland, one at Grangemouth and one near Peterhead. (32) As part of the plans for the regeneration of the Craigmillar area of Edinburgh, a feasibility study is being carried out into the use of CHP. (33) PB Power is also currently carrying out a feasibility study for the City of Edinburgh Council for schemes in Granton and Muirhouse.

Yet feasibility studies have not been carried out consistently in all local areas where heat networks are likely to deliver significant energy and heat savings. Nor has deployment reached the level for which there is potential. Government interventions are needed to assist, including financial support for up-front costs, support through land-use planning with positive encouragement for heat mapping by local authorities, and support to local authorities in establishing ESCOs to develop district heating schemes.

10. CHP tackles intermittency

As moves towards higher penetration rates for renewable electricity gain momentum, the electricity supply system has to be able to manage a significant increase in periodic renewables, while still maintaining supply to the customers. The intermittency of renewables, and wind in particular, demands flexibility of response for operation from other suppliers on the grid. That is why the successful combination of CHP and renewables is attracting increasing attention. (34) Presently in Denmark, when the wind speed drops by 1 metre per second the country needs to find an additional 350 MW of electric power capacity. Gas CHP has the capacity to respond quickly to such fluctuation, but to maintain high efficiency the system must also find a use for the heat produced when generating electricity. In Europe, traditional CHP users are beginning to find new ways (such as temporary heat storage or buffering) to meet this need for flexibility. Danish district heating companies are increasingly providing the grid with balancing services, and the Danish model shows how a combination of a high wind-generating capacity and CHP can run together smoothly. (35)

In Germany, micro combined heat and power (CHP) has been identified as the solution to balancing wind in the network. LichtBlick is the largest independent energy supplier in Germany and has announced its goal to place 100,000 micro CHP systems with an electric output of 20 kW each into homes and buildings in Germany. The property owner will be provided with the cogeneration unit and a heat storage unit and be guaranteed that the home will be supplied with heat as required. (36)

Micro CHP is an innovative new technology, which has significant potential to reduce carbon emissions. There are several competing technologies, but all would replace a conventional domestic central heating boiler, and produce electricity as well as hot water for heating. In terms of capacity, if all domestic gas boilers were to be replaced (as they reach the end of their useful life) with micro CHP, the UK could in theory install around 150,000 micro CHP units every year. By 2020, this could be the equivalent of a new large power station powered by micro CHP. (37)

11. Anaerobic Digestion

Anaerobic digesters break down organic waste naturally into a solid that can be used as fertiliser and a gas that can be burnt to generate heat or electricity. The UK Government hopes an agreement with the National Farmers' Union will lead to the use of 1,000 anaerobic digesters by 2020. At present there are estimated to be around 20.

The digesters are expected to make many farms self-sufficient in electricity. Any excess could go to the national grid. (38) The Scottish Government is planning to require households and businesses in Scotland to separate out food waste by 2013 for separate collection and dispatch to anaerobic digesters. Already anaerobic digestion plants are springing – one being built by Scottish & Southern Energy at Barkip, North Ayrshire, capable of processing 80,000 tonnes of waste a year, is due to be completed next year. And a £7.5m digester for Scottish

Water Waste Services in North Lanarkshire, able to recycle 30,000 tonnes of waste food a year, will be operational this summer. (39)

The water industry - which has to deal with 1.73 million tonnes of sewage sludge annually, businesses which produce food waste, and local authorities, could all make use of digesters. If all the organic waste in Britain were recycled in this way, enough energy would be generated to provide two million homes with heat and electricity. The National Grid says waste could be used to generate enough gas to heat half our homes. (40) In North West England United Utilities (UU) has unveiled plans for its Davyhulme sewage treatment works to be the first to inject biogas into the natural gas network. The project will allow United Utilities and National Grid to compare the relative efficiency and cost effectiveness of the three main uses for biogas - onsite CHP, gas grid injection and vehicle fuel. If successful, the gas injection project could also pave the way for the widespread adoption of grid injection facilities for other companies operating biogas plants making an important contribution to the government's renewable heat ambitions. (41)

12. Launching a local energy revolution

Local authorities have called for an increased role in providing the energy efficiency strategy. The Local Government Association (LGA) for England and Wales said there are too many different schemes aimed at cutting household emissions. These should be merged into a single £7 billion fund to allow councils to embark on a more cost-effective programme. Councils want to build on the example of Kirklees Council which has offered to insulate every house in its area for free. If a similar council led scheme was expanded across the country, it would save £2 billion on current plans to put basic insulation into every home. (42)

The UK Government's Low Carbon Transition Plan says the Government will explore how to unlock greater action by local authorities in identifying the best potential for low carbon community scale solutions in their areas. Chair of the Nuclear Free Local Authorities, Dundee Labour Councillor George Regan said *"Local Authorities have a crucial role to play in the local energy revolution and are keen to get on with implementing it. Yet in 2003 we were promised a step change in energy efficiency by the UK Government – and we are still waiting. We cannot afford to wait another six years while the Government 'facilitates new nuclear reactors' and tries to work out how to unlock greater action by local authorities."* (43)

13. Suggested NFLA Scotland recommendations for the Scottish Government to consider

- The Scottish Government needs to continue to support the development of the offshore wind industry in Scotland so that it can meet its full potential, whilst paying due regard to its environmental impact.

- The Scottish Government should seek to increase support to the wave and tidal industry with the aim of becoming the world-leader in this fledgling industry. It should work towards achieving a target of 2GW of installed capacity by 2020.

- Climate and energy policy must be integrated with the goal of eliminating fuel poverty by 2016 with a primary focus on improving the efficiency of existing buildings.

- The Scottish Government should continue to support the country's nascent small-scale renewable industry and the development of micro-CHP by setting a target of generating 10% of Scotland's electricity from micro-generation by 2020.

- The Scottish Government should develop a strategy for introducing CHP and district heating into areas which could benefit from this technology. It should begin by supporting projects which have already been shown to be feasible. It should encourage the schemes identified by Poyry at Grangemouth and Peterhead to go-ahead.

- The Scottish Government should commission research on the role CHP can play in tackling the problem of intermittency. It should also support the development of a supply chain for micro-CHP and encourage the replacement of old boilers with micro-CHP where appropriate.

- The Scottish Government should continue to support the development of anaerobic digestion and the collection of food and farms waste. It should also encourage further work of the re-injection of biogas into the gas grid.

- The Scottish Government should harness the local knowledge and expertise of local authorities to launch a local energy revolution.

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