

briefing



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No.99

Subject: Following the German example? An NFLA assessment on whether the Scottish 'renewable revolution' in energy policy is being realised.

1. Background to briefing

This briefing has been developed by the NFLA Scotland Policy Advisor Pete Roche. It is a detailed update of his September 2011 NFLA Policy Briefing 89 and is the first of a series of four updated reports looking at future energy policy in Scotland, England, Ireland and Wales that will be produced over the summer. It promotes the NFLA's approved energy policy that a combination of a wide renewable energy mix, microgeneration and energy efficiency can provide the energy needs for each country without recourse to new nuclear power generation.

2. Executive Summary

- The Scottish Government has set ambitious targets for the equivalent of 100% of electricity demand to be produced from renewables by 2020 and 30% of overall energy demand.
- The Scottish Government does not oppose an extension to the lives of existing nuclear reactors in Scotland, meaning that the country is unlikely to become non-nuclear until after 2033.
- An influential report by leading energy consultants, Garrad Hassan, shows how 185% of Scotland's electricity could be produced from renewables by 2030 whilst phasing out fossil fuels and not extending the life of nuclear reactors.
- The nuclear station at Hunterston B is older than most of the reactors already shut down in Germany following the Fukushima disaster.
- Crucial to Germany's plans to phase-out nuclear power completely by 2022 is the plan to reduce electricity consumption by 2020 by 10%. In contrast the Scottish Government expects electricity consumption to rise between 2011 and 2020 by almost 10%.
- It is widely agreed that energy prices will increase over the next 20 years whether there is a switch to a low carbon, non-nuclear energy system or not, so it is crucial that due regard is prioritised to the needs of the 900,000 households in Scotland suffering from fuel poverty.
- Scottish energy efficiency programmes and minimum standards for dwellings will need to be much more ambitious if targets are to be met.
- Whilst decarbonisation of heat will be necessary if large-scale electrification of heating can be avoided where possible, this could go a long way towards negating the need for new reactors south of the border and extending the life of old reactors in Scotland.
- This can be done by promoting combined heat and power systems, geothermal energy.

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- Feeding gas into the gas grid from the anaerobic digestion of organic waste requires further research and development.
- The 'Low Carbon Scotland' report sets a target of at least 100,000 homes to have adopted some form of individual or community renewable heat technology for space and/or water heating by 2020, but there is no specific target for electricity produced by microgeneration. A target should be set which is commensurate with the idea that all houses should have some form of low and zero carbon technology by 2050.
- Energy Efficiency targets will have to be increased to meet European regulations which require a minimum reduction of 17% by 2020.
- The introduction of electric and hybrid vehicles should be accompanied by a goal of stabilising total car km at 2001 levels by 2021.
- With improved interconnection to other countries as well moderate investments in storage and deferrable demand, it is possible to phase out all conventional thermal generation capacity in Scotland by 2030 and still deliver a secure and reliable electricity supply.
- Scotland does not need to risk unnecessarily extending the lives of aging nuclear plants.

3.1 Introduction

In June 2011 the Scottish Energy Minister Fergus Ewing published the '2020 Routemap for Renewable Energy in Scotland'. (1) This outlined the steps needed to meet some ambitious targets, including supplying the equivalent of 100% of electricity demand from renewables by 2020. It also set out plans for achieving targets for renewable heat and transport and set a new target to meet 30% of total energy (as opposed to just electricity) demand from renewables by 2020. These targets put Scotland on a par with leading European countries and the 30% target is double the UK Government target. (2) The roadmap also set a new target to deliver 500MW of community and locally owned renewable energy by 2020.

Unfortunately, the Electricity Generation Policy Statement, published in March 2012, made clear that these targets do:

"...not mean that Scotland will be 100% dependent on renewables generation: renewables will form part of a wider, balanced electricity mix, with thermal generation [fossil fuels and nuclear] continuing to play an important role". (3)

Fossil Fuels and nuclear could still be providing 30% of electrical output in 2020, and fossil fuels without carbon capture and storage and nuclear could still represent 20% of Scottish electricity capacity.

3.2. Nuclear Plant Life Extensions

The Electricity Generation Policy Statement also makes clear that *"the Scottish Government would not oppose operating life extension applications"* for nuclear reactors at Hunterston and Torness.

Fergus Ewing told the Scottish Parliament in June 2011 there was a *"rational case"* for extending the life of Scotland's two nuclear plants, and that the government was *"perfectly open"* to the continued use of Hunterston and Torness to ensure security of supply. (4) Hunterston has already had a five year extension to 2016 and EDF Energy has made clear that it will apply for a further life extension. (5) Torness is currently due to close in 2023. If it achieves the same life extensions which Hunterston aspires to, it could still be open in 2033.

3.3 Non-Nuclear Alternatives

In December 2010, a report by the leading energy consultants Garrad Hassan, for Scottish environment groups, called *"The Power of Scotland Secured"*, showed that Scotland could phase out all conventional fossil fuel and nuclear power stations by 2030, and still produce 185% of Scotland's electricity needs, maintain a secure electricity supply, and generate revenue from renewable exports. By combining this level of renewable electricity production

with moderate efficiency measures, Scotland could decarbonise at least 50% of its total energy needs (not just electricity) by 2030, and it would not be necessary to risk extending the lives of EDF Energy's two nuclear stations located in Scotland. (6)

For some time it has been widely acknowledged that Scotland is well placed to meet 100% of its electricity requirements from renewables in the not too distant future. A paper by Scottish Natural Heritage (SNH) in 2009 suggested this might be relatively easy. (7) The Electricity Generation Policy Statement says the 100% renewable target will require around 16 Gigawatts (GW) of renewable capacity (for comparison Torness has a capacity of 1.2GW).

3.4 Scottish Route Map in Numbers

Installed Capacity required	~ 16 GW (Gigawatts)
Current renewable installed capacity	4.2 GW
Under construction	1.2 GW
Consented	2.1 GW
In planning	4.1 GW
In Scoping	15.4 GW
Total	27 GW
For comparison Torness is rated at	1.2 GW

3.5. Wave and Tidal Power

Most of these projects are onshore and offshore wind with some wave and tidal power. Of the 22.8GW still under construction or being planned or in scoping, 10GW is offshore wind, 9.4GW onshore wind, 1.6GW wave and tidal and 1.2GW hydro. (See the previous NFLA Policy Briefing Number 89 - "Realising the Scottish Renewables Revolution in Energy Policy, http://www.nuclearpolicy.info/docs/briefings/NFLA_Policy_Briefing_89_Scottish_energy_update.pdf 16th September 2011)

In August 2012 the UK Department of Energy and Climate Change (DECC) announced the establishment of a Marine Energy Park in the Pentland Firth and Orkney Waters. This will incorporate the world-leading European Marine Energy Centre (EMEC) in Orkney which attracts developers from across the world and where testing of a wide range of wave and tidal energy devices is already under way. The purpose of the park is to heighten the international profile of the region and its reputation as a world leader in marine energy. Energy from waves or tides has the potential to generate 27GW of power in the UK alone by 2050 mostly in the two areas now designated Marine Energy Parks – the North of Scotland and South West England. (8)

3.6. Role of Scottish Local Authorities

This report will focus on smaller-scale renewables and energy efficiency and look in particular at energy plans on the scale which would give a role to local authorities to play in moving Scotland to a climate friendly non-nuclear energy system, which doesn't require extending the life of ageing nuclear reactors.

4.1 Scotland and Germany: Efficiency is the key

Scottish Energy Minister Fergus Ewing said in May 2011 that Scotland is ideally placed to follow a similar route to Germany, where eight nuclear reactors which were opened between 1975 and 1984 were closed following the Fukushima disaster, and all its other nuclear reactors being closed by 2022. (9) Yet Hunterston B, which was opened in 1976, is older than most of the reactors already closed in Germany.

On 28th June 2012 Ewing met with politicians from the Baden-Württemberg State Government to discuss shared interests and opportunities in the growing domestic and international low carbon economy. Mr Ewing discussed the similarities between the energy policy and ambition

of Scotland, Baden-Württemberg and Germany at national level, and the shared emphasis on the importance of renewables playing an increasing role in energy security and supply. The Scottish Government Press Release, however, did not highlight the differences between Scotland and Germany. (10)

4.2 **Germany's electricity consumption to go down: Scotland's to go up**

Crucial to Germany's plans to phase-out nuclear power by 2022 is the plan to reduce electricity consumption by 2020 by 10%. In contrast the Scottish National Party's mini-manifesto: "*Our ambitions for clean green energy*" showed that the Scottish Government is planning for an increase in electricity consumption of around 9.5% between 2011 and 2020 – despite aiming to decrease consumption of energy (as opposed to just electricity) by 12% over the same period. (11) The Scottish Government's 2020 Routemap for Renewable Energy points out that electricity demand may rise in the long term due to greater use of electricity for transport and heat. (12)

Similarly the UK Government expects **demand for electricity to double by 2050** because of the need to electrify large parts of the industrial and domestic heat and transport sectors – and this is one of the Coalition's key arguments for promoting new nuclear reactors in England and Wales. (13) This compares with Germany's plans to reduce electricity demand by 25% by 2050, as well as phasing out nuclear power and meeting similar carbon reduction targets to the UK and Scotland. (14)

4.3 **Energy Bills to Rise Whatever We Do**

It is widely agreed that energy prices will increase over the next 20 years whether there is a switch to a low carbon, non-nuclear energy system or not, (15) so it is crucial that due regard is prioritised to the needs of the 900,000 households in Scotland suffering from fuel poverty. (16) Ofgem has predicted that, in the worst-case scenario, household energy bills could double to £2,000 a year within a decade, but this figure now looks too low. (17) So reducing household energy consumption, whilst keeping people's homes warm and light will be crucial regardless of whether there is a need for savings to meet climate targets.

In Germany two Government Ministries published the "*Energy Concept*" report which shows how Germany will become one of the most energy-efficient and greenest economies in the world whilst also enjoying competitive energy prices and a high level of prosperity. The German Government is committed to an 80% reduction in greenhouse gas emissions by 2050, as is Scotland and the UK. But the backbone of Germany's plan is energy efficiency. By 2020 primary energy consumption is to be 20 % lower than in 2008 (compared with a 12% cut in Scotland) and 50 % lower by 2050. Compared with 2008, Germany plans to cut electricity consumption by around 10 % by 2020 and 25 % by 2050. (18)

4.4 **Giving buildings an 'Energy Makeover' is key**

Germany's plan is to be partly achieved by renovating 2% of the total building stock every year, and reducing final energy consumption in the transport sector by about 10 % by 2020 and by about 40 % by 2050 (compared with 2005). The minimum efficiency standards for buildings will be gradually raised and a long-term modernisation plan developed for the existing stock of buildings. Overall, primary energy demand of buildings should fall 80 percent by 2050. But as well as tightening up regulations the Government will also enhance the economic incentives for energy efficiency modernisation.

The German KfW banking group shows how a Green Investment Bank should operate, unlike plans in the UK. It borrows freely in order to transform the energy efficiency of the nation's homes. Funding for KfW's CO₂ building rehabilitation programme will be raised from international markets at low interest rates. The UK's fledgling equivalent will neither borrow nor support energy efficiency programmes. The UK Green investment bank has £3bn of taxpayers' money and will not, as it stands, support any home refurbishments, despite many experts saying this is exactly the sort of investment it should assist.

Since 2001, KfW loans have helped insulate and seal over 2m homes, employing 200,000 people a year in the process. The key is very low interest rates, currently 1-2%, compared with plans for the Green Deal to charge up to 7.5%. (19) The UK government plans Green Deal loans around £10,000. German homeowners can borrow up to €75,000 via KfW. The latter sum provides a very cosy and efficient home often including some domestic low-carbon power generation. In the KfW scheme, the higher the aim, the better the deal. For the most efficient homes – Passivhaus standard¹ - the householder gets up to 12.5% of the loan handed back to them. Householders that don't like loans can get grants of up to 20% of the cost of the works. It all adds up to a massive commitment to energy efficiency. (20)

5.1 **Scottish Energy Efficiency Plan**

Almost 90% of existing buildings are expected to be still standing in 2050. So 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. To do this 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. (21)

5.2 **Sustainable Housing Consultation**

The Scottish Government is currently consulting on a Sustainable Housing Strategy (22) which sets out a vision for warm, high quality, affordable, low carbon homes and a housing sector that helps to establish a successful low carbon economy across Scotland. This was accompanied by a consultation on developing an energy efficiency standard for social housing. (23)

The Sustainable Housing Strategy's sets out objectives to:

- deliver a step-change in provision of energy efficient homes to 2030 through retrofit and new build;
- ensure that no-one in Scotland has to live in fuel poverty, as far as practicable, by 2016;
- make a full contribution to the Climate Change Act targets; and
- enable the refurbishment and house-building sectors to contribute to and benefit from Scotland's low carbon economy and to drive Scotland's future economic prosperity.

The strategy proposes a National Retrofit Programme which by 2030 will see every suitable home to have loft and cavity wall insulation; every home heated with gas central heating to have a highly efficient boiler with appropriate controls; and at least 100,000 homes to have adopted some form of individual or community renewable heat technology for space and/or water heating. This programme will make use of the UK Green Deal and Energy Company Obligation. Local Authorities will play a leading role in making the National Retrofit Programme offer available to householders.

5.3 **Using Regulation to Achieve Minimum Efficiency Standards.**

The Existing Homes Alliance, which brings together social, environmental and business interests from across Scotland, welcomed the launch of the consultation as a 'major step on the road to making all homes in Scotland fit for the 21st Century.' (24) The consultation seeks views on the use of minimum standards to drive improvements in energy efficiency in the private sector. The Existing Homes Alliance wants a timetable for the introduction of regulations on the energy performance of existing houses. (25)

¹ Meaning the heating requirement in a Passivhaus is reduced to the point where a traditional heating system is no longer considered essential <http://www.passivhaus.org.uk/standard.jsp?id=122>

The Scottish Government has also launched a consultation on a proposed Energy Efficiency Standard for Social Housing (ESSH). The consultation proposes setting a minimum Energy Performance Certificate (EPC) rating which all social rented housing should meet by 2020. The rating will vary depending on the house type and source of fuel to heat the dwelling, so a mid-floor flat with gas central heating will be expected to reach a higher rating than an end-terraced house with electric storage heaters. The consultation also proposes setting higher standards to be met beyond the initial 2020 deadline. The financial sustainability of social landlords remains a key consideration, and probably as a result of this the standards do not look very ambitious. (26)

These two consultations make some very welcome proposals. But, of course, if the efficiency standards proposed are not high enough then Scotland won't be able to achieve its carbon targets. A WWF Scotland report from 2008 shows how Scotland's existing homes could be transformed into low carbon homes and emissions from the domestic sector cut by 80%. (27) 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.

The Existing Homes Alliance suggests the minimum energy standard for all private houses should be set at an Environmental Performance Certificate (EPC) score of E from 2015 with the standard raised to C by 2020. An upgrade (if necessary) would be required on point of sale or transfer of occupancy or when major renovations were being carried out. The Scottish Government's proposal for social housing only reaches C in 2020 for certain types of housing. (28)

6.1 Renewable 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. At a UK level heat accounts for about 44% of UK energy consumption, mostly for heating homes and providing hot water, using individual domestic boilers – 84% of UK homes are heated by gas. The Scottish Government has set a target which requires 11% of the heat consumed in 2020 to come from renewable sources, compared with 2.8% currently. 31% of heat use is in the industrial sector, 51% in the domestic sector and 18% in the commercial and public sector. (29)

6.2 Electrification of Heating

The '2020 Renewables Route Map' argues that the 100% electricity target should not be considered in isolation from other energy and climate change targets, all of which create a degree of interdependency. In particular it highlights the interrelationship between electricity and heat targets. A growth in the use of heat pumps (to replace oil-fired central heating for example) may increase demand for electricity. (30) Similarly the UK's Heat Strategy backs electrification as the main supply focus, since '*electricity is universally available*' and, in well insulated houses, heat pumps can make using it for heating relatively economic. It talks about "*increased demand for electricity as expected electrification of heat and transport offset increased efficiency in electricity use.*" (31) This is why the UK Government sees electricity demand doubling by 2050 and the Scottish Government expects electricity demand to increase by 10% by 2020.

But if large-scale electrification of heating could be avoided, this could go a long way towards negating the need for new nuclear reactors in England and Wales and extending the life of old nuclear reactors in Scotland. District heating networks, using gas, waste heat from power stations or heat from biomass combustion, to heat houses and other buildings collectively, are

common across much of continental Europe, especially in the North. There are also some large solar-fed heat grids and many heat stores. There are even some inter-seasonal heat stores, which help to deal with variable supplies over the year, and variable demand for heat, e.g. during winter evenings. The 'Heat Plan Denmark' study financed by the Danish District Heating Association, argues that District heating is the key technology for implementing a CO₂ neutral Danish heating sector in a cost effective way. They claim that the Danish heating sector can be CO₂ neutral by 2030 by upgrading and expanding the existing system, with, for example, heat pumps being used to upgrade the heat energy currently supplied and more heat stores being added. At present much of the system still uses gas as the main energy input, but they look to the use of more renewables, and more efficient waste-to-energy Combined Heat and Power (CHP) plants with flue-gas condensation. So the emphasis will shift increasingly to using large-scale solar heating, biomass /biogas CHP, geothermal energy and excess wind energy – and more heat storage. (32)

Electricity demand was almost 41,000 GWh in 2010. This could be reduced to 35,180 GWh by 2030 in line with Scottish Government policy – before any new consumption due to heat switching and transport is added on. The 'Power of Scotland Secured' report assumes that 40% of heat demand is met from renewable sources in 2030. Using electric heat pumps to contribute to this renewable heat target could increase electricity demand in 2030 to around 40,105 GWh.

6.3 CHP in Scotland

There are several 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 have been established, CHP plants could be converted to biomass or solar at a later date as technology develops and other sources of heat such as geothermal, and heat from anaerobic digesters fed with food and farm waste and waste heat from industry could be fed into the system.

Aberdeen already has three schemes run by Aberdeen Heat and Power Co Ltd (33) – an independent, not-for-profit company established to develop and manage the CHP schemes: the Stockethill project supplies heat and hot water to 268 flats in 4 high rise blocks; the Hazlehead project supplies 200 flats in 4 high rise blocks, a Sheltered housing scheme, school and swimming pool; and the Seaton project supplies 740 flats in 10 high rise blocks, a sports changing facility, the Council's beachfront complex comprising Beach Ballroom, Beach Leisure Centre and Linx Ice-Rink, and Aberdeen Sports Village in Linksfield Road. It will also link in the Aquatic Centre which is currently under construction.

There are also schemes in Clydebank (34) and Edinburgh University has three schemes (35) and is planning a fourth. (36) 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. (37)

6.4 Heat Mapping

The Scottish Government funded a heat mapping pilot in the Highland Council area which was published in June 2011. Heat mapping (a spatial matching of potential supply with demand) has been highlighted as a key tool to encourage local planning authorities to maximise opportunities for local heat use. The methodology used in the pilot can be replicated by other local authorities in order to help imbed renewable energy at the centre of local strategic planning. Funding has been provided to Fife and Perth and Kinross Councils to take forward heat mapping in their local authority areas using the methodology from the pilot undertaken in the Highlands.

The Scottish Government's district heating loan scheme opened in 2011 to provide loans for both low carbon and renewable in order to overcome a range of infrastructural issues and costs associated with these projects. Over £1.9 million will be shared between nine projects that have been offered loans under the scheme. The successful projects will heat around 280 homes as well businesses, schools, swimming pools and community centres.

An Expert Commission on the Delivery of District Heating has been established. The Commission is made up made up of academics, industry leaders, local authorities and environmental groups. The Commission members will have a wealth of experience in district heating policies as well as implementation on the ground, and will provide recommendations which will ensure a major shift to district heating in Scotland. Their first meeting took place early 2012.

The Scottish Government published a report on "A study into the recovery of heat from power generation in Scotland" in October 2011, which examined the potential for heat recovery from four sites in Scotland used for large scale fossil fuel power generation - Peterhead, Longannet, Cockenzie and Hunterston. While the focus was on the potential to recover heat from fossil fuel stations, any heat network that is developed, whether initially intended for low carbon or renewable heat, can be utilised to also deliver renewable heat. The report concluded that while it is technically possible to recovery significant amounts of heat from the four large power station sites, the financial returns wouldn't be very attractive for investors. It did, however, recommend that the wider potential for district heating in Scotland is investigated. (38)

7. **Geothermal Energy**

Deep Geothermal Energy which can be tapped by drilling wells a mile-or-more-deep into underground reservoirs or by pumping water down to be heated by the rocks, (39) can contribute hot water to a district heating system, as is done in Southampton, (40) or, if the water is hot enough, can be used to generate electricity.

Scotland's geothermal potential was regarded as inferior to that of Cornwall and the North of England following the studies of the 1980s, but a Senior Lecturer at the Department of Earth & Environmental Sciences, St. Andrews University, Ed Stephens, has been arguing this is a mistaken prediction of the heat flow which has been underestimated as a result of the last glaciation. This view is now gathering wider acceptance. It is now thought there might be significant potential, and by using the skills of the oil industry Scotland could make progress in harnessing this resource.

In June 2011 deep geothermal energy featured for the first time in the Scottish Government's Routemap for renewable energy - identified as an emerging technology of importance to Scotland. (41) By November 2011 Scottish Enterprise had commissioned a study to locate a site for a geothermal demonstration project. In early 2012 the Scottish Government commissioned a year-long study of the national geothermal potential and the policy framework required to encourage commercial investment.

Researchers at St Andrews University are investigating three types of deep geothermal resources that could be exploitable within Scotland. (42)

- Research into the hot sedimentary aquifers in the Central Belt suggests they could support urban and industrial heat demands. These occur primarily in the Upper Forth region near the Kincardine Bridge and in Fife near Kirkcaldy. They are 2-3 km deep. Projects would be similar to those proposed for the Upper Rhine in Germany. (43)
- Secondly, other research into hot rocks suggests enhanced geothermal systems could generate electricity in the Grampian Highlands, Northern Highlands and Galloway. Here the rocks could be hot enough to generate electricity from steam derived from cold water pumped down from the surface, thereafter spinning a turbine as in conventional power generation. But these resources are even deeper - up to 5km.

- Thirdly shallow mine waters concentrated in abandoned coal workings in the Central Belt are potential sources of low grade heat that could be used in space heating. Residents in the Glenalmond Street estate in Shettleston, a traditional inner-city area in Glasgow's East End, are utilising geothermal heat in their homes. A borehole of 100 metres depth is used to extract water at 12°C from flooded coal mine workings. The water is increased to 55°C using a heat pump and circulated to 16 newly built homes. The scheme has been successfully operating since 1999. There was a similar scheme at Lumphinnans in Fife, but this was vandalised in 2005.

A demonstration project was planned for a new town development at Shawfair in Midlothian on the site of the disused Monktonhall colliery. This was dropped in 2006 and the land sold to developers in 2011. In view of the introduction of the Renewable Heat Incentive this scheme could be re-visited. (44) Water has to be continuously pumped out of this 900 metre deep mine in order to avoid pollution. (45)

Research to date indicates significant potential in Scotland at all depths and the Scottish National Minewater Potential Study (PB Power) 2004 indicated that minewaters alone could potentially contribute up to 27% of the Scottish Government's 11% renewable heat target. (46)

8. **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 100. The digesters are expected to make many farms self-sufficient in electricity. Any excess could go to the national grid. (47) But the methane gas could also be fed into the gas grid, rather than being burnt (inefficiently) to produce electricity. The National Grid says waste could be used to generate enough gas to heat half our homes. (48)

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 up – one built by Scottish & Southern Energy at Barkip, North Ayrshire, capable of processing 75,000 tonnes of waste a year, became operational in 2011. (49) And a £7.5m digester for Scottish Water Waste Services in North Lanarkshire, able to recycle 30,000 tonnes of waste food a year, is also operational. (50)

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. There are three main uses for biogas - onsite CHP, gas grid injection and vehicle fuel. In North West England United Utilities (UU) had plans for its Davyhulme sewage treatment works to be the first to inject biogas into the natural gas network, but this has hit problems. (51)

The 2020 Renewables Routemap recognises the benefits of anaerobic digestion (AD) and separate collections of food waste.

9.1 **Scotland and Microgeneration**

In June 2012, the Scottish Government published its Microgeneration Strategy. (52) This is a sectoral routemap, which sits alongside the Renewables Routemap 2020. The Strategy outlines Scottish Government aims and ambitions for the growth of Microgeneration in Scotland. The strategy focuses on the development of a strong market base by 2020, and how the Scottish Government, industry and other stakeholders can work together to remove barriers to uptake, raise awareness and ensure we have a skilled workforce to deploy microgeneration.

The Low Carbon Scotland report sets a target of at least 100,000 homes to have adopted some form of individual or community **renewable heat technology** for space and/or water heating by 2020. It also sets a new target of 500 MW for community and locally owned renewable energy by 2020. (53) To achieve this milestone, there needs to be a significant increase in the uptake of renewable heat technologies by individual households, matched by a growth in the number of households on district heating. If microgeneration is to deliver half of this milestone - 50,000 installations - by 2020, the uptake in renewable heat technologies would need to increase to at least 5,000 per year. The development of the domestic market will create economies of scale which will benefit business and community installations.

But there is no specific target for Microgeneration which encompasses electricity producing technologies such as solar photovoltaics.

The main financial incentives for microgeneration are:

- Feed-in Tariffs (FiT) (54)
- Renewable Heat Incentive (RHI) (55)
- Renewable Heat Premium Payment (RHPP) (56)

These are reserved to the UK Government with the agreement of the Scottish Government. The Scottish Government is also engaged with the UK Government on development of the 'Green Deal' which includes microgeneration amongst the various measures it can support.

The Scottish Government Strategy is to maximise the uptake of the RHPP, RHI and FIT in Scotland. It also provides financial support to assist householders install renewables through its Home Renewables Loans Scheme, which was boosted by £5 million on 22nd June 2012. (57) There is also the Community and Renewable Energy Scheme (CARES) for communities (58) and Small Business Loans. (59) A Warm Homes Fund will open in autumn 2012 to support communities in areas with high levels of fuel poverty, to help them to set up projects providing lower-cost energy generated from renewable sources, reducing fuel bills for individual households, and/or creating new funding streams through the RHI and similar incentive payments. The Fund will open with funding of £3.25m available, and will take the form of loans for actual installations, and grants for feasibility studies and options appraisals.

Based on Energy Saving Trust figures, the 'Power of Scotland Secured' report calculated that microgeneration could be supplying around 7,000GWh of electricity in Scotland by 2030 and 15,000GWh of heat.

9.2 **Microgeneration and Energy Efficiency**

The Scottish Government also plans to reduce Scottish final energy consumption by 12% by 2020 compared to a three year average over three years 2005-7. This is set out in the Energy Efficiency Action Plan: Conserve and Save. (60) The uptake of microgeneration will be strongly linked to this. The European Union has agreed on a legally-binding energy efficiency target which requires all 27 EU member states to collectively reduce their energy consumption by a minimum of 17% by 2020 compared to 2007. So the Scottish target will presumably have to be increased. (61)

10. **Sustainable Transport**

Similarly if Scotland achieves 10% market penetration of electric vehicles by 2020, as recommended in the Route Map, a WWF Scotland report suggests an additional 1TWh (1,000 GWh) of additional electricity production will be required. (62) WWF Scotland points out that electricity demand from Electric Vehicles should and could be managed to match night time falls in demand when wind generation capacity is still potentially high. As well as having a 2020 target of 10% of transport fuels from renewables, the Scottish Government is committed to achieving complete decarbonisation of road transport by 2050, with significant progress by 2030 through wholesale adoption of low and ultra low carbon vehicles.

The report 'Power of Scotland Secured' considers two different scenarios in 2030. Electricity demand was almost 41,000 GWh in 2010. Both scenarios assume this can be reduced to 35,180 GWh by 2030 in line with Scottish Government policy – before any new consumption due to heat switching and transport is added on. If traffic is allowed to grow in line with Government forecasts to 2020, all internal combustion engine (ICE) vehicles must be replaced with hybrid or electric vehicles (EVs) by 2030 in order to meet the target emissions reduction. This would require almost 3,800GWh of electricity annually. Alternatively if a goal of stabilising total car km at 2001 levels by 2021 is attained, and ICE efficiencies improve to the extent that the UK Committee on Climate Change forecasts, then the numbers of battery electric and plug-in hybrid numbers need not grow so rapidly, making up only 17.9% and 42.9% of the car population respectively by 2030, requiring 1,700GWh.

11. **Security of Supply**

One of the reasons given in the Scottish Government's Electricity Generation Policy Statement for supporting possible extensions to the operating life of Scotland's existing nuclear stations is to help maintain security of supply while the transition to renewables and cleaner thermal generation takes place. The 'Power of Scotland Secured' report shows how Electric Vehicles can act as electricity storage systems, and CHP systems offer another opportunity to manage variability in electricity supply if developed alongside heat storage. In Denmark, which has a very high level of CHP district heating systems, heat storage has been identified as an important measure to allow high integration of wind energy. CHP stations could prioritise electricity production over heat production when there is low wind, and allow surplus electricity production from wind generation at other times to be used to charge the heat stores, using heat pumps.

The 'Power of Scotland Secured' report concludes that with improved interconnection to other countries and moderate investments in storage and deferrable demand, it would be possible to phase out all conventional thermal generation capacity in Scotland by 2030 and still deliver a secure and reliable electricity supply.

12. **An Alternative Routemap**

Virtual decarbonisation of electricity *supply* could be achieved if all remaining large scale fossil fuelled generation were closed down by 2030, or were fully fitted with carbon capture and storage technology. This, of course, depends upon Carbon Capture and Storage (CCS) technology proving both technically effective and economically feasible, which is by no means certain.

The 'Power of Scotland Secured' report says that by 2020 renewables could be providing over 100% of Scotland's electricity needs, and 185% by 2030. By combining this level of renewable electricity production with moderate efficiency measures, Scotland could decarbonise at least 50% of total energy needs by 2030. With improved interconnection and moderate investments in storage and deferrable demand, it would be possible to phase out all conventional thermal generation capacity in Scotland by 2030 and still deliver a secure and reliable electricity supply. These conclusions depend on only moderate efficiency and conservation achievements, below the targets set by the Scottish Government. More ambitious energy demand – at German levels for example - across all sectors would make system reductions security and emissions reductions far easier and cheaper to deliver, and would reduce household fuel bills.

Scotland does not need to risk unnecessarily extending the lives of aging nuclear plants. Nor does it need to take the financial and climate risks of new coal plant.

The following table explains the potential figures of production from various renewable sources using the two scenarios of a moderate efficiency and conservation programme, and the more ambitious German programme:

	Current	Low Renewables	High Renewables
Onshore Wind	1918MW	6738 MW (by 2020)	7500MW (by 2020)
Offshore Wind	180MW	3000 MW (by 2020)	7000MW (by 2024)
Hydro	1387MW	2200MW (by 2030)	2500MW (by 2030)
Wave & Tidal	Negligible	1260MW (by 2023)	2520MW (by 2024)
Biomass	79MW	355MW (by 2018)	1030MW (by 2030)
Energy from Waste	100MW	125MW (by 2015)	150MW (by 2020)
TOTALS	3664MW (3.7GW)	13678MW (13.7GW)	20700MW (20.7GW)

13. Conclusions

In the NFLA Scotland Forum's view:

- There is no need for the Scottish Government to support risky life extensions for EDF Energy's two nuclear stations at Hunterston and Torness.
- Scotland could phase out all conventional fossil fuel and nuclear power stations by 2030, and still produce 185% of Scotland's electricity needs, and maintain a secure electricity supply.
- Scotland should aim to cut electricity consumption by around 25% by 2050 as is planned in Germany.
- The fact that energy bills will rise over the next decade irrespective of the energy path which is followed underlines the need to prioritise domestic energy efficiency programmes on a much more ambitious scale than is currently proposed.
- Regulation should be used to improve the EPC rating of Scottish housing, both social and private.
- Combined Heat and Power with district heating networks should be promoted as a major contributor to meeting renewable heat targets.
- Geothermal Energy should be promoted as a major source of heat for district heating networks.
- Anaerobic digestion should be developed both as a source of renewable heat and electricity as well as a possible source of "green gas".
- Microgeneration should be expected to provide 15-20% of Scottish electricity supplies by 2030.
- The increase in demand caused by the electrification of the transport sector need only be modest.
- Security of supply can be boosted by grid links between Scotland and other countries; deferring demand; making use of electric vehicles for storage; and boosting storage capacity. CHP plants can be used to balance variability from wind power if used in conjunction with heat stores.

14. Scottish Government Renewable Energy Sectoral Route Maps

Sector	Route Map	Current	Planned
Offshore Wind	Offshore Wind Industry Group, Sept 2010	185MW	10 GW
Onshore Wind		3.4 GW installed or under construct	2 GW consented 3.5 GW awaiting decision 3.9 GW scoping
Wave & Tidal	Marine Scotland will be taking forward development of a Sectoral Marine Plan for Marine Renewables in Scotland's Renewable Energy Zone during 2011.	3.25MW + 5.9 MW being installed	1.6GW
Renewable Heat	Renewable Heat Action Plan for Scotland , Scottish Government November 2009.	2.8% 1696GWh	11% by 2020

	<p>Renewable Heat in Scotland 2010 (Progress Report by Energy Saving Trust) March 2011</p> <p>Renewable Heat Action Plan Update December 2011.</p> <p>A study by AEA Technology into the potential to recover “waste” heat from fossil fuel power stations in Scotland. September 2011</p> <p>The Scottish Government is committed to funding heat mapping for local authorities.</p>		1504 GWh under construction or planned
Bioenergy & EfW	Includes Anaerobic Digestion (AD) – plans to start food waste collections and encourage farm waste AD take-up	1565GWh	65MW (heat) of CHP in pipeline. EfW could contribute 2TWh of heat and 0.9TWh electricity.
Hydro	Scotland’s undeveloped hydro potential now estimated at 1.2GW in a new report compared with previous estimate of 657MW: The Employment Potential of Scotland’s Hydro Resources , Nick Forrest and Jamie Wallace, September 2009.		An extra 1.2GW
Micro-generation	Microgeneration Strategy for Scotland , Scottish Government 22 nd June 2012	1322 installs = 7.5MW electricity 2500 installs for heat = 53MW	Target could be 15% of electricity by 2020
Energy Storage	AEA’s Energy Storage and Management Study for the Scottish Government, October 2010. http://www.scotland.gov.uk/Publications/2010/10/28091356/0		
Geothermal	Planning Guidance now includes a section on Geothermal Energy Geothermal Update 7 th March 2012.		
Community Renewables	A Community and Landowner Renewable Energy Loan Fund Feasibility Study. http://www.scotland.gov.uk/Publications/2010/10/01105500/9	CARES helped 105 schemes = 53MW	500 MW target for 2020
Energy Efficiency	Conserve and Save: The Energy Efficiency Action Plan for Scotland, October 2010, http://www.scotland.gov.uk/Resource/Doc/326979/0105437.pdf		Reduce final energy consumption by 12% by 2020

15. References

- (1) 2020 Routemap for Renewable Energy in Scotland, Scottish Government, June 2011
<http://www.scotland.gov.uk/Publications/2011/08/04110353/0>
- (2) Business Green 30th June 2012 <http://www.businessgreen.com/bg/news/2083058/scotland-boosts-renewables-ambition-cent-2020>
- (3) Electricity Generation Policy Statement 6th March 2012
<http://scotland.gov.uk/Resource/0038/00389294.pdf>
- (4) Times 1st July 2011 <http://www.thetimes.co.uk/tto/news/uk/scotland/article3080652.ece>

- (5) Largs & Millport Weekly News 11th April 2011
<http://www.largsandmillportnews.com/news/roundup/articles/2011/04/11/412213-hunterstonnuclearcan-go-to-2021/> & Largs and Millport Weekly News 1st September 2010
<http://www.largsandmillportnews.com/news/roundup/articles/2010/09/01/404629-hunterstonunionswant-new-nuclear/>
- (6) The Power of Scotland Secured, report & summary, FoE-Scotland, RSPB Scotland, WWF Scotland, December 2010 <http://www.foe-scotland.org.uk/sites/files/possv6final.pdf>
- (7) Facilitating sustainable development of renewable energy generation, Scottish Natural Heritage, November 2009. http://www.snh.org.uk/data/boards_and_committees/main_board_papers/2009-Dec9/FacilitatingSustainableDevelopmentOfRenewableEnergyGenerationCapacity.pdf
- (8) DECC Press Release 30th July 2012
http://www.decc.gov.uk/en/content/cms/news/pn_091/pn_091.aspx
- (9) Scotsman 30th May 2011 <http://www.scotsman.com/news/scotland-wants-german-style-nuclear-shutdown-says-snp-1-1667497>
- (10) Scottish Government Press Release 28th June 2012
<http://scotland.gov.uk/News/Releases/2012/06/Sharedgoals28062012>
- (11) Our ambitions for clean green energy, SNP April 2011
http://nationbuilder.s3.amazonaws.com/snp/pages/453/attachments/original/A4_Renewables_Doc_Apr11_WEB.pdf?1303819936
- (12) 2020 Routemap for Renewable Energy in Scotland, Scottish Government, July 2011
<http://www.scotland.gov.uk/Resource/Doc/917/0118802.pdf>
- (13) Overarching National Policy Statement for Energy (EN-1) DECC, July 2011 para 2.2.22.
<http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/consents-planning/nps2011/1938-overarching-nps-for-energy-en1.pdf>
- (14) Energy Concept for an environmentally sound, reliable and affordable energy supply, Federal Ministry of Economics and Technology & Federal Ministry for Environment, Nature Conservation and Nuclear Safety, September 2010 <http://www.bmwi.de/English/Redaktion/Pdf/energy-concept%2Cproperty=pdf%2Cbereich=bmwi%2Csprache=en%2Crwb=true.pdf>
- (15) Business Green 17th December 2010 <http://www.businessgreen.com/bg/james-blog/1933425/energy-bills-rise-gbp500-low-carbon-plans>
- (16) Scottish Local Government Election 2012, Special Report on Fuel Poverty, Energy Action Scotland 2012
<http://www.theclaymoreproject.com/uploads/associate/365/file/EAS%20Publications/LG%20election%20report%202012.pdf>
- (17) Sunday Times 1st May 2011
http://www.thesundaytimes.co.uk/sto/business/energy_and_environment/article615632.ece
- (18) Energy Concept for an environmentally sound, reliable and affordable energy supply, Federal Ministry of Economics and Technology & Federal Ministry for Environment, Nature Conservation and Nuclear Safety, September 2010 <http://www.bmwi.de/English/Redaktion/Pdf/energy-concept%2Cproperty=pdf%2Cbereich=bmwi%2Csprache=en%2Crwb=true.pdf>
- (19) Business Green 2nd July 2012 <http://www.businessgreen.com/bg/news/2188479/labour-raises-fears-green-deal-rates>
- (20) Guardian 24th May 2012 <http://www.guardian.co.uk/environment/damian-carrington-blog/2012/may/24/green-investment-bank-energy-efficiency>
- (21) Boardman, B. Home Truths: A Low Carbon Strategy to Reduce UK Housing Emissions by 80% by 2050, FoE (EWNl) and Co-operative Bank, November 2007.
http://www.foe.co.uk/resource/reports/home_truths.pdf
- (22) Homes that don't cost the earth, a consultation on Scotland's sustainable housing strategy, Scottish Government June 2012 <http://www.scotland.gov.uk/Resource/0039/00395756.pdf>
- (23) Developing an Energy Efficiency Standard for Social Housing: A Consultation, Scottish Government, June 2012 <http://www.scotland.gov.uk/Resource/0039/00395811.pdf>
- (24) WWF Scotland Press Release 26th June 2012
http://scotland.wwf.org.uk/what_we_do/latest_wwf_scotland_news.cfm?6073/Scottish-Government-moves-towards-a-sustainable-housing-strategy
- (25) Existing Homes Alliance <http://www.existinghomesalliancescotland.co.uk/>
- (26) Developing an energy efficiency standard in social housing, Scottish Government, June 2012
<http://www.scotland.gov.uk/Resource/0039/00395811.pdf>
- (27) CAG Consultants & Energy Action Scotland, Carbon Countdown for Homes: How to make Scotland's Existing Homes Low Carbon. WWF Scotland October 2008
http://assets.wwf.org.uk/downloads/retrofit_1.pdf
- (28) WWF Scotland Press Release 6th June 2011
http://scotland.wwf.org.uk/what_we_do/press_centre/?4983/Call_for_rapid_upgrade_of_Scotlands_worst_energylated_homes

- (29) Renewable Heat Action Plan for Scotland: a plan for the promotion of the use of heat from renewable sources, Scottish Government November 2009
<http://www.scotland.gov.uk/Resource/Doc/290657/0089337.pdf>
- (30) Scottish Government Press Release 30th June 2011
<http://www.scotland.gov.uk/News/Releases/2011/06/30094005> and 2020 Routemap for Renewable Energy in Scotland. <http://www.scotland.gov.uk/Publications/2011/08/04110353/0>
- (31) The Future of Heating: A Strategic Framework for Low Carbon Heat in the UK, DECC, March 2012
<http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/heat/4805-future-heating-strategic-framework.pdf>
- (32) Green Heat - District Heating and Energy Storage by Professor Dave Elliott, Environmental Research Web 22nd January 2011 <http://environmentalresearchweb.org/blog/2011/01/green-heat---district-heating.html>
- (33) Aberdeen Heat and Power Co. Ltd <http://www.aberdeenheatandpower.co.uk/>
- (34) Clydebank Housing Association, CHA Power Ltd. <http://www.clydebank-ha.org.uk/cha-power-ltd.html>
- (35) Somervell, D. University of Edinburgh's Sustainable Future, District Energy, Fourth Quarter 2006, http://www.eauc.org.uk/file_uploads/district_energy_article_dec06_.pdf
- (36) Holyrood CHP and District Heating, University of Edinburgh, September 2011
http://www.seagog.estates.ed.ac.uk/docs/open/Paper_7_-_HolyroodCHP.pdf
- (37) AEA Technology, Mitigating Against Climate Change in Scotland: Identification and Initial Assessment of Policy Options, Scottish Government, November 2008.
<http://www.scotland.gov.uk/Resource/Doc/244863/0068651.pdf>
- (38) A study into the recovery of heat from power generation in Scotland. AEA Technology, Scottish Government, September 2011 <http://www.scotland.gov.uk/Resource/Doc/362183/0122534.pdf>
- (39) Energy Quest. <http://www.energyquest.ca.gov/story/chapter11.html>
- (40) <http://www.southampton.gov.uk/s-environment/energy/Geothermal/>
- (41) 2020 Routemap for Renewable Energy in Scotland, Scottish Government June 2011. Para 3.8 page 107. <http://www.scotland.gov.uk/Resource/Doc/917/0118802.pdf>
- (42) Potential for Exploiting Geothermal Energy in Scotland, St Andrews University. http://www.st-andrews.ac.uk/~wes/research/Geothermal_overview.html
- (43) See http://www.energy-base.org/fileadmin/media/regioner/docs/geothermal-energy-rhine-valley_FINAL.pdf
- (44) Wikipedia entry on Shawfair <http://en.wikipedia.org/wiki/Shawfair> & BBC 26th June 2006
http://news.bbc.co.uk/1/hi/scotland/edinburgh_and_east/5117600.stm Shawfair Minewater Project, Scottish National Minewater Potential Study, PB Power May 2004
<http://www.scotland.gov.uk/Resource/Doc/982/0056515.pdf>
- (45) Stephens, E. Reassessing Scotland's Geothermal Potential. UK First Geothermal Symposium 2011.
- (46) Deep Geothermal Energy Update March 2012, Scottish Government.
<http://www.scotland.gov.uk/Resource/0038/00389365.pdf>
- (47) Farmers Guardian 11th July 2012 <http://www.farmersguardian.com/home/renewables/uk-needs-to-get-it-skates-on-over-ad-experts-warn/48247.article>
- (48) Telegraph 2nd February 2009 <http://www.telegraph.co.uk/earth/greenerliving/4431157/Sewage-could-be-used-to-heat-half-the-homes-in-Britain.html>
- (49) Let's Recycle 17th June 2011 <http://www.letsrecycle.com/news/latest-news/compost/sse-to-open-scotland2019s-largest-ad-facility>
- (50) Scottish Water Deerdykes Anaerobic Facility, Chartered Institution of Waste Management, 18th May 2011 http://www.ciwm.co.uk/web/FILES/ScotlandRDO/website_info_-_deerdykes_site_visit.pdf
- (51) Utility Week 15th June 2011
http://www.utilityweek.co.uk/news/news_story.asp?id=195528&title=Injecting+biogas+into+the+natural+gas+grid and Water Briefing 3rd November 2011
<http://www.waterbriefing.org/index.php/home/energy-and-carbon/item/4868-sewage-gas-for-grid-projects-hit-problem>
- (52) Microgeneration Strategy for Scotland, Scottish Government 22nd June 2012
<http://www.scotland.gov.uk/Publications/2012/06/9678>
- (53) Low Carbon Scotland: Meeting the Emissions Reduction Targets 2010-2022, Scottish Government March 2011 <http://www.scotland.gov.uk/Resource/Doc/346760/0115345.pdf>
- (54) http://www.decc.gov.uk/en/content/cms/meeting_energy/Renewable_ener/feedin_tariff/feedin_tariff.a_spx
- (55) http://www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/incentive/incentive.aspx

- (56) http://www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/premium_pay/premium_pay.aspx
- (57) Home Renewables Loan Scheme <http://www.energysavingtrust.org.uk/scotland/Take-action/Grants-and-offers/Home-renewables-loan-scheme>
- (58) CARES Update 4th June 2012 http://www.communityenergyscotland.org.uk/latest/news/1070_cares_update_4_june_2012
- (59) Small Business Loans <http://www.energysavingtrust.org.uk/scotland/Take-action/Business-funding/Small-business-loans>
- (60) Conserve and Save: The Energy Efficiency Action Plan for Scotland, Scottish Government October 2010. <http://www.scotland.gov.uk/Resource/Doc/326979/0105437.pdf>
- (61) Business Green 15th June 2012 <http://www.businessgreen.com/bg/news/2184557/eu-lowers-sights-binding-energy-efficiency-targets>
- (62) Watt Car? WWF Scotland, May 2010 http://assets.wwf.org.uk/downloads/evs_report_web2.pdf