

Enterprise and Culture Committee

6th Report, 2004 (Session 2)

Renewable Energy in Scotland

SP Paper 194

Session 2 (2004)

Remit and Membership

Remit:

To consider and report on matters relating to the Scottish economy, business and industry, energy, training, further and higher education, lifelong learning and such other matters as fall within the responsibility of the Minister for Enterprise and Lifelong Learning; and matters relating to tourism, culture and sport and such other matters as fall within the responsibility of the Minister for Tourism, Culture and Sport.

Membership:

Alasdair Morgan (Convener)

Brian Adam

Mr Richard Baker

Chris Ballance

Susan Deacon

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Committee Clerking Team:

Clerk to the Committee

Simon Watkins

Senior Assistant Clerk

Judith Evans

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1. The Committee reports to the Parliament as follows-

THE ARGUMENT

Introduction

2. The exploitation of Scotland's renewable energy resources is one of the biggest challenges facing the nation.
3. Scotland is uniquely positioned to exploit a range of renewable resources; a successful renewables policy can contribute as much to the nation's economic growth, particularly in more marginal areas, as it can to environmental policy.
4. The increasing evidence of global climate change and the damage caused by greenhouse gas emissions create an urgent stimulus for action. The UK is committed to meet the Kyoto targets for reducing these, and Scotland must play its part.
5. We also now live in a much less certain world in terms of geopolitics and energy supply. The UK, to give one example, will become a net importer of gas in 2005 and of oil in 2010, much of it from politically less stable parts of the world. There is now an imperative for an effective renewables policy, not just to be 'green', but also to keep the lights on. This would have been unthinkable only 5 years ago.
6. The Enterprise and Culture Committee is wholly supportive of the Executive's ambitious renewable energy targets. Throughout its inquiry it has sought to examine whether the targets will be met and whether the Executive is effectively exploiting the potential for renewable energy to achieve them.
7. The inquiry has therefore focussed on electricity generation, to which the targets apply. The Committee has not examined energy conservation in any great depth, although some evidence was received on the issue and it is an essential component of a sustainable energy policy. Neither has the Committee taken substantial evidence on other aspects of renewable energy production for transport or space and water heating, although these are touched upon in the report.
8. Renewable energy is an issue that affects all of us. For this reason we have set out to present the core of our report in as coherent and readable way as possible.

THE CURRENT SITUATION: 2010 TARGETS

Meeting Targets

9. The Executive has set a target of 18% of electricity generated in Scotland to be from renewable sources by 2010, and an 'aspirational' target of 40% by 2020. Current generation from renewable sources stands at around 12% of the total.
10. **It is clear from the evidence that the Committee has taken that the Executive will meet its short term target of 18% of electricity from renewable sources by 2010.**
11. **However, this increase will come almost entirely from onshore wind generation,**

which raises a number of major issues in relation to the future of renewable energy in Scotland.

THE RELIANCE ON WIND

12. The construction of onshore wind farms is the easiest and cheapest way for the energy supply companies to meet their targets for renewable generation under the Renewable Obligations (Scotland) (ROS) scheme. It requires only existing, tried technology, and is technically straight-forward to construct.

13. As a result, there has been a rapid development of wind power by the generating companies over the last two years. Respondents to the Executive's consultation on renewable energy warned that this would happen - and it has. Today 255MW¹ is delivered to the grid by wind farms - by the end of 2005 this will be almost 700MW.

14. The live applications before planning authorities, if they were all built, could provide twice the energy required to meet the Executive's target in 2010. Progress in other forms of renewable energy generation has not kept pace.

15. The Renewables Obligation (Scotland) scheme has been successful, but in a single direction - that of promoting onshore wind power. It has led to the invigoration of the market for wind power by energy companies, but without developing other sectors. Whilst this may be welcome in terms of meeting targets, it has raised concerns over the merits of wind power and has not stimulated other renewables generating technologies to a significant degree. By focussing power companies' attention on wind, it may even have hindered the commercialisation of other renewable technologies.

16. This is a significant issue for a number of reasons which are outlined below.

Economic Impact

17. There are excellent examples of significant local economic benefit arising from wind power development. Jobs that are created in rural areas, are often disproportionately important. As part of the inquiry, the Committee visited the Vestas wind turbine plant at Machrihanish, which now employs almost 300 people.

18. The Vestas development is a very welcome one, but there appears to be limited scope for increasing the economic benefit of wind power to Scotland. The dominant companies in this field are foreign, particularly Danish. So far most of the equipment bought has been 'off the shelf' and this brings relatively little benefit to the Scottish economy. In particular, the increase in higher value jobs will not be as significant as it would otherwise be if the firms were domiciled in Scotland.

19. Electricity is of course a Scottish export, so there are benefits that accrue to Scotland in term of income and jobs, particularly as the major power companies are still significantly Scottish-domiciled. There are also of course indirect economic effects and benefits from a shift to renewables, such as reduction in the costs of dealing with pollution from fossil fuels or other conventional technologies. These are real benefits, although much harder to

quantify.

Neglecting Other Renewables Technologies

20. The energy companies, operating under the quasi-market conditions created for them by the Executive, are putting very substantial investments into certain types of wind energy. It is the obvious, sensible, low-risk, smart commercial decision. But the effect is that other technologies are being starved of the level of investment which would allow them to develop and compete. Substantial sums of public money are being invested to manipulate the electricity generating market for public good; however at present that investment is going almost exclusively into onshore wind.

21. The Executive's current renewables policy is unintentionally working against the development of renewable energy sources other than onshore wind.

Creating Vulnerability

22. This over-reliance on one source of renewable energy is not good energy policy.

23. Energy policy should seek to develop a number of different sources of energy to protect security of supply and allow energy to be drawn from different sources under different conditions. An effective policy will also include efforts to reduce our demand for energy by incorporating energy efficiency measures.

24. In this respect the reliance on large onshore wind farms generates an additional problem due to its dependence on appropriate meteorological conditions and the potentially intermittent nature of wind energy generation.

25. Whilst it is unlikely that poor generating conditions will exist across the entire country at any one time, this is an issue that needs to be considered.

26. Whilst Scotland can draw on energy sources beyond its borders, this is limited by the inter-connector (the main electricity grid link to England), and we should not therefore be in a situation where we rely too heavily on onshore wind power.

27. The Executive's 40% renewables target for 2020 must not be met entirely from large onshore wind farms - at the moment we are unable to say with certainty that this will not be the case.

Public Reaction to Wind Farms

28. There is significant opposition to onshore wind farm development in many areas in Scotland. However, it would be a mistake to assume that this opposition is universal, and the Committee has received equally persuasive evidence from voices supporting their development.

29. Some of the arguments put forward against wind farm developments carry more substance than others. There will be situations where individuals' concerns relate fundamentally to self-interest and where initial fears may not be borne out in practice. There will be other cases where wind farm developments will genuinely impact negatively

on nationally or regionally important areas. There are good locations for wind farms, and there are poor ones.

30. The Committee firmly supports the Executive's commitment to increase renewable energy generation and believes that onshore wind must form an important part of that increased capacity. To achieve this there will need to be more onshore wind farms. However, there does currently appear to be a proliferation of large onshore wind farm proposals concentrated in sensitive geographical areas, with which the planning system is struggling to cope.

31. All those affected - developers, local authorities, objectors - believe that there are major weaknesses in the current planning system and a lack of clear guidance from the Executive.

32. The system simply cannot cope with the scale of applications or the pace of change - there will be a 40% increase in the total number of wind farms this year alone. It is time for a new approach.

33. The Executive must take an active lead and develop a national strategic framework for wind farm applications, and engage with local authorities on how to deliver this within their areas. This could include arriving at agreements with local authorities as to their contribution to meeting the energy targets, and extending guidance.

34. There are a number of advantages to this approach. It should lead to a reduction in the level of speculative applications, and could allow more local discretion and decision-making, resulting in speedier and more sensitive decisions. The current review of the planning process provides an ideal opportunity to achieve this. All planning fees, even those currently paid to the Scottish Executive, should be paid to local authorities.

35. Crucially, if more effort and investment were to be devoted to other renewables technologies, the requirement for the growth in the number of large onshore wind farms would reduce and their siting could be more selective and considerate of the views of local communities.

THE NEED FOR A SCOTTISH ENERGY POLICY: 2020 TARGETS

Meeting Targets

36. The Scottish Executive's current renewables policy is working in the narrow sense that it is promoting the rapid expansion of renewable energy in the form of onshore wind farms. The 2010 target will be met. However, in the medium term the policy is unsustainable and will not capitalise on the enormous economic opportunities that are presented by renewable energy.

37. As things stand, if the Executive's 40% renewables target for 2020 is to be met, it will be almost entirely through onshore wind power. This is neither sustainable nor sensible.

The Need for a Policy

38. Energy policy overall is of course a reserved issue, and the energy market is essentially a UK one, with some energy being bought and sold across borders. However, the Executive has responsibility for renewable energy policy, and therefore, in effect has already created a de facto Scottish energy policy through the introduction of the Renewables Obligation (Scotland) scheme. Energy sectors are inter-dependent, and the introduction of the ROS has already had a profound impact on the Scottish energy market. This is clear from all the evidence received in the inquiry.

39. The energy market in Scotland and our needs are profoundly different from those of England. The energy mix, the scale and location of demand, the siting of power plants, topography - all are different. This is already evident from renewables policies north and south of the border. The UK renewables target for 2010 was 10%, compared to 18% in Scotland, and is 20% for 2020, compared to 40% for Scotland. A different, explicit yet complementary and co-ordinated energy policy is required in Scotland.

40. The Executive should therefore accept the reality of the situation and create a comprehensive Scottish energy policy, which would take account of the UK context and the areas in which it operates in co-operation with Westminster.

41. The policy should identify the most appropriate and balanced mix of energy supply technologies as well as comprehensive energy efficiency and demand reduction measures.

ELEMENTS OF THE POLICY

A New Renewables Obligation (Scotland)

42. The first element of an energy policy should be a revised Renewables Obligation. The Executive is currently planning to review the ROS in 2005-6. This is too late - it needs to be done now. There has been rapid change since the system was introduced in April 2002, and it is already out of date.

43. The initial ROS has already had an enormous impact on the Scottish energy market, but almost solely in promoting onshore wind power. The situation needs to be rectified now to avoid further damage being done by, for instance, squeezing out other new renewables technologies such as wave and tidal power, biomass and biofuel, offshore wind, etc.

44. The ROS needs to be refined into a more sophisticated policy tool that allows other types of renewable energy to be incentivised, not just onshore wind.

45. This requires careful manipulation of the market and close co-operation with the UK Government, the power companies, technology suppliers, developers and financiers. However, there are a number of pressing reasons why it must be done.

Green Jobs

46. Scotland is in a unique position to be able to create significant numbers of green

jobs through encouraging and investing in leading edge renewables technologies.

47. Scotland has natural resources unrivalled in Europe for the generation of energy from marine sources. This is new technology with several countries vying for control of the market. Portugal, for instance, is making a determined attempt to become the leader in the marine sector.

48. Whoever wins this competition will enjoy major economic benefits, as the technology spreads around the world. We can lead the world and reap the benefits if we invest now. There are potentially jobs in research and development, design, manufacturing, export, licensing, consultancy, in fact in almost every area of the economy. The Executive estimates that the total number of jobs in renewables will increase at least 10-fold over the next 15 years. The number of jobs created will vary according to how successful we are in promoting the technology - in the marine sector for instance estimates of the number of jobs vary from a few hundred to 24,000 by 2015, depending on the level of investment.

49. The Committee believes that the opportunities and potential benefits presented by the renewables energy sector are so great that the Executive should be prepared to invest significantly in the sector. It should be treated as a priority sector by the enterprise networks and the full range of business support mechanisms should be brought to bear on its development. In circumstances where the private sector is risk averse the Scottish Executive should take the lead.

50. Scottish Enterprise has of course created the Intermediate Technology Institutes, one of which is for energy and has an annual budget of £15m. This is welcome, but it is not enough. The £15m is spread across the whole of the energy sector, which is of course substantial in Scotland, and there will be potential draws on it from many other technologies in the oil and gas industries.

51. Developing the sector is not just about throwing money at it, and a refinement of the ROS should have a major impact in encouraging private investment. But the Executive must prioritise the renewables sector, and use all the tools at its disposal to ensure that it succeeds, from proof of concept funding to assisting the commercialisation of technology. This should include looking at the skills aspects of developing the sector, since concerns were raised in evidence that the supply of skilled workers could be a constraint on its expansion. There is also a need to maximise the match-funding available from the European Union in its various research and technological development programmes.

52. This is one of the big opportunities facing the Scottish economy, and one of the major challenges facing the Scottish Executive as a whole. Great rewards can be reaped through a more effective linkage of economic and energy policy. A Scottish energy policy could help to achieve this.

Alternatives to Onshore Wind Power

53. The energy policy should seek to shift the focus from large onshore wind farms to other forms of renewable power.

54. If it is successful in this, it will create jobs, since there is more scope for 'home-grown'

jobs within these others sectors.

55. **Marine** renewables energy generation appears to offer the greatest potential for further development. Scotland has a leading competitive position in this sector and can become to wave and tidal power what Denmark is to wind power. Impressive steps have already been taken, such as the establishment of the European Marine Energy Centre in Orkney, but more needs to be done to reinforce Scotland's position.

56. Through its extensive commercial forests and coal deposits Scotland is also well resourced with the raw materials for the exploitation of energy production from **biomass**, both on a small and a large scale. There is significant scope for increasing the number of 'co-firing' biomass plants and for much greater use of carbon sequestration technology². Scotland could realistically aim to promote these to the level of importance these technologies enjoy in Denmark or Germany. In addition, co-firing has significant potential as a technology for use with other forms of waste, for instance oil. Biofuels can also be used in combination with waste to generate power.

57. The drawback of intermittency which affects wind power also means that effective renewable energy storage mechanisms must be developed or renewables will never be able to reach their full potential. Scotland has already developed a unique cluster of companies and academics in the field of **hydrogen fuel cell technology** which does exactly this. The commercialisation of this technology should be a focus for investment by the Executive and a part of the energy policy.

58. **Offshore wind** farms, depending on their location, do not suffer from many of the drawbacks attributed to some of those onshore. However, there do appear to be some barriers to further development around Scotland under current and foreseeable technologies. There are of course also barriers to the linkage of offshore sites to the national grid in some areas, but these problems affect many renewables sources and a fundamental rethinking of the grid strategy may be necessary in any case. It would probably be unrealistic to expect offshore wind to contribute much further to the achievement of the Executive's 2010 target, although a contribution could be made by 2020.

59. **Community-developed wind farms** - There are a growing number of developments which have been brought forward in co-operation with local communities, or whose genesis lies with the local community itself. The Committee has been impressed by a number of these schemes and by agency work in support of them, and by how successful this approach has been abroad. In many ways this may represent the future for onshore wind generation. It is another area which could benefit from the concentration of further resources and expertise.

60. **Other renewables** - The potential of micro renewables, such as solar panels and small wind turbines, should also not be over-looked. Micro wind turbines now have the capability to supply SMEs as well as domestic demand, and solar panels for water and space heating are becoming much more widespread. The scale of these technologies means that they will currently have a limited impact on meeting the renewables targets, but there is the potential for a significant culture change in this area as they become more commonly adopted by individuals. By contrast the potential for major hydro developments has largely been exploited, although a limited number of smaller schemes and efficiency upgrades can

contribute to the growth of renewable energy production.

Security of Supply Issues

61. If the Executive's current policy continues for much longer there is a real risk that, within the renewables sector, there will be an over-reliance on wind energy which will threaten the security of supply. A wind energy component of 20% of electricity generation has been reached in Denmark, for instance, but no country has gone beyond this to date.

62. At present there is no preferred mix of renewable energy sources specified by the Executive. Rather the market has been left, with the incentives created by the ROS scheme, to find its own solutions. This is seen as a technology neutral strategy, but it is not - it favours onshore wind, because it is cheaper and relatively risk free. This situation cannot be allowed to continue unchecked. The Executive must establish what is the reasonable upper limit for wind as part of the energy mix, beyond which security of supply is threatened. It must begin to give indications within a coherent energy policy of how it sees the contribution of each source and also of energy efficiency measures.

Energy Conservation

63. Energy conservation must be a key part of a Scottish energy policy, and the policy should include targets for conservation.

64. Scotland is again different from the rest of the UK in that our climate means that there are greater benefits to be had from, for instance, building insulation. Scotland's model for energy conservation should be the Scandinavian states, who are many years ahead of us in this area.

Sustainable Energy

65. The Scottish Executive should consider ways of incorporating sustainable energy in all public procurement. The need for the use of sustainable energy should be reflected in all arrangements for Best Value and Public Private Partnerships.

The Grid

66. A new energy policy must also include a view on the future of the national grid in Scotland.

67. The current grid was created under a twentieth century model of energy generation linking it to a relatively small number of big power plants, predominantly located on the coast. That model is having to be rethought as the pattern of generation changes with the advent of renewables. The grid is being turned on its head. Currently it is a major barrier to the long-term development of renewables.

68. As with various other elements of energy policy, the Executive does not have control of the grid. Nevertheless, it must set out its vision, to assist in creating a policy framework for the power companies, the owners of the grid and generators. That vision must include Executive support for sensitive infrastructure projects to open up access to renewables generating sites, and the encouragement of a similar view from Ofgem, for instance

regarding the Beaully-Denny transmission line upgrading.

69. There may be significant environmental impacts from these kinds of upgrades and a significant body of objections, similar to those for wind farms, both of which must be carefully handled. However, it is also important, given its importance to the future of renewables, that the Executive takes a lead on the issue and ensures that local and national interests are considered in planning decisions on grid upgrades.

70. The Executive should also challenge the orthodoxy of grid management and prompt its operators to manage the grid in new ways. There may be solutions other than heavy engineering ones that can increase its capacity. We can learn from others who are developing this philosophy in North America and elsewhere.

Non-Renewables

71. However successful the renewables policy is in the coming years, at least 60% of Scotland's energy will still need to be generated from non-renewable sources. It has not been the purpose of this inquiry to examine this or to speculate on an appropriate overall energy mix.

72. There are very difficult decisions to be taken on the future of energy generation from nuclear and fossil fuel sources and some of them will have to be taken quite soon. It is important that Governments face up to their responsibilities in this regard and do not delay decisions which could undermine future energy supply. Under any scenario, advantage should be taken of the major opportunities that exist to produce cleaner and more efficient energy within conventional thermal generation.

CONCLUSION

73. Potentially, renewable energy has a very bright future in Scotland. It can be a major contributor to our energy supplies and it can help tackle global environmental problems. It can deliver some security for the future and it can deliver huge economic benefits, including jobs and exports. However, if it is to do this it will require a more concerted effort by the Scottish Executive and the creation of a coherent Scottish energy policy.

SUMMARY OF EVIDENCE

INTRODUCTION

Remit and definitions

74. The remit agreed by the Committee for the inquiry was:

"To inquire into the development of renewable energy in Scotland. Specifically, the Committee will wish to ask the following questions, which are intended to be illustrative rather than prescriptive:

- **Will the Executive targets be met, under current circumstances, and are they appropriate?**

- how were they arrived at by the Executive?
- what is the relationship with UK targets?
- have assumptions been made about the contributions of different sectors?
- what are the opportunities and implications for the economy in achieving the targets?
- what are the implications if the Executive's targets are not met?
- **If not, why not? (What are the current barriers, and what action needs to be taken to ensure that the targets are met?)**
 - **global issues**
 - the Renewables Obligation (Scotland) and the UK energy legislative framework
 - the electricity market
 - the transmission network (inc. the Scottish national grid)
 - **local issues**
 - What opportunities are there/should there be for local community involvement in, and economic benefit from, renewable energy schemes?
 - **examination by sector**
 - onshore wind (inc. planning issues, community development)
 - offshore wind (inc. UK strategy, role for energy ITI?)
 - wave/tidal (inc. technology issues, job potential)
 - hydroelectric
 - biomass
 - other/longer-term (e.g. emerging technology, non-electricity)

• **Are there implications for the reliability of supply if the Executive's aspirational target is met?'**

75. The UK statutory definitions of fossil fuels and renewable energy are as follows:³

"fossil fuel means coal, substances produced directly or indirectly from coal, lignite, natural gas, crude liquid petroleum, or petroleum products"

"renewable sources means sources of energy other than fossil fuel or nuclear fuel, but includes waste of which not more than a specified proportion is waste which is, or is derived from, fossil fuel."

76. At the beginning of this inquiry the Committee agreed that it wanted to hear from as wide a selection of witnesses and organisations as possible. While this included groups which are most active in the debate on renewable energy, such as the power generators, environment and energy interest groups and the Scottish Executive, the Committee also wished to take evidence from other groups whose voice may be heard less often, such as small scale private developers, public petitioners and community representative organisations. The initial basis for the inquiry was set out in the remit. The Committee was particularly keen to examine the social and economic potential for Scotland to benefit from

the development of the renewable energy sector.

77. As well as taking oral and written evidence the Committee was anxious to see practical examples of renewable energy at work in Scotland and to examine the roles it plays in local communities. Members of the Committee undertook three case study visits to Aberdeen, Kintyre and Orkney and one overseas visit to Denmark. The Committee also held a formal meeting and a public participation event in Campbeltown on the Kintyre peninsula in January 2004.

78. Given the huge interest amongst the Scottish public on the subject of renewable energy the Committee has received a very large volume of evidence. It would be impossible for this report to refer to all submissions received. The summary of evidence seeks to highlight the major themes and messages which have emerged from this inquiry. A complete copy of all of the evidence received is available on the Enterprise and Culture Committee's website at:

<http://www.scottish.parliament.uk/enterprise/index.htm>

Collection of evidence

79. The Committee issued its call for written evidence on this inquiry on 13 November 2003 and began taking oral evidence from witnesses on 6 January 2004. As part of its evidence gathering for the inquiry the Committee was anxious to hear from as wide a field of witnesses as possible. By the end of the oral evidence taking session on 30 March 2004, the Committee had received 144 written submissions and taken oral evidence from 50 witnesses representing 34 different organisations and groups.

80. On 6 January 2004 the Committee took evidence from Dr Robin Wallace of the Institute of Energy Systems and Mr Blair Armstrong and Mr Brian Nixon of Scottish Enterprise.

81. On 13 January 2004 the Committee heard from five public petitioners on the subject of proposed onshore wind farm developments in various areas of Scotland. They were: Mrs Marilyn Henderson, Mr WR Graham; Christine Grahame MSP; and Mr Peter Hodgson, John BP Hodgson and Ben Palmer of the Skye Wind Farm Action Group. The Committee also took evidence on that day from Councillor Alison Hay, Mr Derek McKim and Mr James Fowlie of COSLA.

82. On 20 January 2004 the Committee held a meeting in the Victoria Hall, Campbeltown in Argyll and Bute. At this meeting the Committee took evidence from: George Harper and Angus Gilmour of Argyll and Bute Council; Mr Steven Watson ALIEnergy; Alan Mortimer and Susan Reilly of Scottish Power; David Sigsworth and Dr Brian Smith of Scottish & Southern Energy; and Robert Forest and Maf Smith from the Scottish Renewables Forum.

83. On 3 February 2004 the Committee took oral evidence from: Mr Adrian Bull of British Nuclear Fuels Ltd; Mr John Thomson and Mr Bill Band from Scottish Natural Heritage; and Dr Dan Barlow (Friends of the Earth Scotland); Anne McCall (RSPB Scotland) and Ian McCall (Ramblers' Association Scotland), all representing the Scottish Environment

Link.

84. On 10 February 2004 the Committee heard from: Dr Chris Anastasi of British Energy and on 2 March 2004 the Committee took evidence from Mr Alistair Buchanan, Mr David Haldearn and Mr Charles Gallacher from Ofgem. The Committee also heard from: Iain Todd from the UK Department of Trade and Industry; Dr Jim Hunter and Elaine Hanton of Highlands & Islands Enterprise; and Dr Richard Yemm, Fergus Tickell and Professor Ian Bryden, representing the Scottish Renewables Forum.

85. On 10 March 2004 the Committee took evidence from Charles Davies and Dr Lewis Dale of National Grid Transco. The Committee also took evidence from Angela Duignan of the Baywind Renewable Energy Co-operative in Cumbria and Mr David Gordon from the Glasgow based company Windsave Ltd.

86. On 23 March 2004 the Committee heard from: Mr Andy Knill of the Civil Aviation Authority; Mr Allan Baillie and Air Commodore Simon Bryant of the Ministry of Defence; and David G Hilton from National Air Traffic Services Ltd. The Committee also heard from Mr Chris Bronsdon and Dr Gary Connor of the Scottish Energy Environment Foundation.

87. Finally, on 30 March 2004, the Committee heard from Mr William Gillett from the Directorate of Transport and Energy of the European Commission. The Committee completed its formal oral evidence taking sessions by hearing from the Deputy Minister for Enterprise and Lifelong Learning Lewis Macdonald, accompanied by Mr Robin Naysmith and Mr Neil Stewart from the Scottish Executive Enterprise Transport and Lifelong Learning Department.

88. As well as taking oral and written evidence the Committee also undertook four fact finding visits to a variety of renewable energy locations in Scotland and abroad.

89. On 19 January 2004 the Committee visited one of Scotland's largest onshore wind farms at Beinn an Tuirc on the Kintyre peninsula. The Committee also visited the Vestas Celtic Wind Technologies plant at Machrihanish in Kintyre. On 16 and 17 February 2004 three members of the Committee travelled to Denmark to examine the development of the renewables sector in that country and see what environmental and economic lessons Scotland could learn from the Danish experience.

90. On 6 and 7 May 2004, three members of the Committee undertook a visit to Orkney to examine the development of various renewable initiatives in rural Scotland. Finally on 10 May 2004, four members of the Committee visited sites in Aberdeen and Fife to examine the research and development aspects of the renewables sector in Scotland.

Major Themes

91. The Committee has received written and oral evidence on a wide range of topics relating to the renewable sector in Scotland. These have ranged from issues of climate change and wildlife protection to jobs, workforce skills and the future of Scotland's economy. Several major themes have developed during the course of the inquiry, namely:

- the current public debate over the development of onshore wind farms;

- progress in developing other renewables technologies;
- potential for capturing the emerging marine renewable market;
- potential economic benefits for local communities and the overall Scottish economy;
- the structure of the electricity market and the transmission grid;
- reduction in energy consumption;
- estimating Scotland's future energy needs and how to meet them; and
- the role of public participation in the renewables debate.

WIND FARM DEVELOPMENT IN SCOTLAND

92. One of the first themes to emerge from the evidence is the public debate on the issue of onshore wind farm development. This issue, more than any other, is driving the current public debate on the renewables sector. Indeed, the Committee has noted that since the start of this inquiry hardly a week has gone by without reference to the subject in the Scottish broadcast or print media.

Onshore Wind - the Current Debate

93. Early in the inquiry the Committee took evidence from five public petitioners on the subject of onshore wind farms⁴. While each of these petitions was specific in nature to a particular geographical part of Scotland, all were objecting to the proposed levels of development of onshore wind farms. All of the petitioners expressed concerns about the number of planning applications for onshore wind farms and all outlined almost identical objections to the potential consequences if these proposed developments were to proceed.

94. It is clear from the evidence taken that the substantial increase in the proposals for new onshore wind farms in Scotland is being driven by the way in which the electricity market is currently structured and the mechanisms put in place for that market to deliver the UK's renewables targets.

95. Under current targets the UK government is committed to generating 15.4% of the country's electricity from renewable sources by 2015 and an 'aspirational' 20% by 2020⁵. These targets form the Government's commitment, as set out in its Energy White Paper of 2003, to reduce the UK's carbon emissions to 60% of current levels by 2050.

96. Scotland already generates approximately 11% of electricity from renewable sources, mostly due to the level of installed hydroelectric capacity. In light of this fact the Scottish Executive is committed to generating 18% of Scotland's electricity from renewable sources by 2010 and an 'aspirational' 40% by 2020. To date, the Executive has not set any specific Scottish targets in relation to carbon emission reductions.

97. In order to achieve its renewable targets, the UK Government has established the Renewable Obligation (RO). This is an obligation on licensed electricity suppliers in England and Wales to supply a specified percentage of their electricity from renewable sources. In Scotland the Renewable Obligation (Scotland) (ROS) applies a similar obligation for licensed electricity generators in Scotland. The RO and ROS are designed to be 'technology neutral'. In essence this means that, while the system specifies the various types of renewable technologies which are eligible for use under the Obligation, the

system does not favour any one technology over another. So, in theory, the market should bring forward a 'mix' of renewable technologies. While a detailed list of the eligible technologies can be viewed on the Department of Trade and Industry website at <http://www.scottish.parliament.uk/enterprise/reports/www.dti.gov.uk>, the main eligible technologies are:

- Landfill and Sewage Gas
- New hydroelectric exceeding 20MW (after 1 April 2002);
- Onshore and Offshore wind power;
- Co-firing of biomass and other biomass;
- Tidal and Tidal stream power;
- Wave power;
- Photovoltaic; and
- Energy crops.

98. To achieve these targets the Government has established a market support system called Renewable Obligation Certificates (ROCs). This system is based on the principle of ensuring the electricity market delivers the required levels of renewables generation by providing a financial support system which allows generating companies to produce electricity at a cost per kWh⁶ which can compete with the cost of producing electricity from cheaper fossil fuel sources.

99. The effect of these targets and the statutory obligations placed on the major electricity generators has been the rapid development of the onshore wind power sector. This situation is magnified by the fact that Scotland, because of its geographical position and meteorological conditions, has the largest proportion of the UK's wind resource. Indeed Scotland's wind resources are among the best in Europe. As a result developers have looked to site the major proportion of onshore wind farm development in Scotland. Some of the public perception of onshore wind farms in Scotland has also been influenced by the practise of developers who submit multiple applications for wind farm developments in various parts of the country. This practice seems to be driven by the 'hit and miss' philosophy of developers maximising their chances of success by lodging numerous planning application.

100. Public concern over this situation is reflected in the evidence received by the Committee from the petitioners. Mr William R Graham for instance stated that at the time he submitted his petition (PE564) to the Parliament in October 2002 there were five wind farm proposals in the Moray area. By January 2004 that number had increased to 13.⁷ This is a reflection of the pace of growth of the onshore wind sector in Scotland and the fact that developers make multiple applications for wind farms in order to increase their chances of success.

101. Much of the concern expressed by the petitioners related to the potential cumulative impact of wind farm development on areas of rural Scotland. There was a generally held concern amongst the petitioners that wide scale development of wind farms could be detrimental to the scenic quality of the landscape and so have an adverse impact on the Scottish tourism industry⁸. While concerns have been expressed about the tourism industry, there is no reliable data on the cumulative visual effect of wind farms on tourism

available. Those who support the development of wind power challenge assertions about potential negative impacts of wind farms on the tourism sector.

102. Concern was also expressed in relation to the potential impact on wildlife, particularly the possible danger to protected bird species from turbine blades⁹. Possible health risks to local residents from issues such as low frequency sound and shadow flicker has also been expressed, though no reliable data on this appears to be available.¹⁰

103. In its evidence to the Committee, Scottish Natural Heritage (SNH) stated that Scotland already had a network of forestry access road and that further damage to the natural habitat could be reduced by utilising this network in the development of the onshore wind farm sector¹¹. On the issue of danger to bird species SNH stated that, while there was some evidence to suggest that a small number of birds have been killed as a result of wind farms, there was not a large enough body of research to demonstrate a firm conclusion on the subject either way. However SNH believes that there is a need to collate reliable data on the issue of bird deaths in relation to wind farms in Scotland¹².

104. In evidence to the Committee, Ann McCall of the Royal Society for the Protection of Birds (RSPB) stated that, to date, wind farm development in Scotland had not caused a major problem for most bird species. However, as the volume of wind farm developments increases throughout the country there could be a cumulative impact on more sensitive bird areas¹³.

105. Many of these concerns are reflected in the current public debate on the issue of wind farm development. While the Committee does not consider that it is in a position to adjudicate on these arguments based on the evidence taken to date, it is clear that public support will be vital for the successful development of the Scottish renewables sector.

106. Another issue that has been raised is the potential impact of wind farms on civil and military aviation. Concerns have been expressed in relation to the operation of radar for air traffic control. The Ministry of Defence (MoD) has also objected to planning applications for the development of onshore wind farms in tactical training areas used by the Royal Air Force.¹⁴

107. On 23 March the Committee took evidence from the MoD as well as the Civil Aviation Authority (CAA) and National Air Traffic Services (NATS) on the implications of wind farms for radar operation and tactical training areas in Scotland. The Committee welcomes the co-operation it received from the MoD, the CAA and NATS. The Committee believes that the ability of Scottish Parliament committees to take evidence from UK Government departments is an important element of their scrutiny process.

108. In evidence to the Committee, Alan Baillie of the MoD stated that much progress had been made to date with wind farm developers and environmental consultants to reduce the number of wind farm proposals which may draw planning objections from the MoD. The MoD is seeking to establish a concordat with the Scottish Executive to set a framework for working relationships in relation to planning applications for onshore wind farm and the needs of the MoD in Scotland.¹⁵ As the renewable sector expands in Scotland such a concordat could also assist in resolving other planning issues between the MoD, developers and planning authorities.

109. The Committee notes the work of the Wind Energy, Defence and Civil Aviation Working Group on radar operations for air traffic control, which is led by the Department of Trade and Industry and on which the Scottish Executive is represented. This group has produced guidelines on the development of onshore wind farms in relation to air traffic control services and other civil and military aviation issues.¹⁶

110. Progress requires society to balance the need to change with the need to protect the physical and social environment for future generations. The major elements of this debate are ably reflected in a submission from Mr John Macdonald on the arguments of protecting the nature and culture of an area like the Highlands with the equally important need to ensure a successful local economy. He states:

"...the most striking impression is the incredible grandeur of what lies before you in every direction. I have always thought that the second most striking aspect of such scenes is the ever-present evidence of man's impact on this landscape throughout the generations. Tracks, waymarking, dykes, ditches, enclosures, fields, plantations, boundaries, dwellings, settlement. These are everywhere. Man is still here and there are roads and fences and forests and pylons and communication masts and villages and a town or two and a hydro-dam. This visual vastness can absorb them all."¹⁷

111. Further on in his submission Mr Macdonald states:

"It is imperative for all who live here from choice to realise that community is what makes this wilderness special, and that every development which offers short-term or long-term employment (and you cannot know in advance what will succeed or fail) should be given the chance unless there are compelling reasons to oppose them.

The prevailing determination to do it the other way round has come to be a millstone which threatens us all. We cannot go on like this."¹⁸

The Role of Onshore Wind Farms in Meeting the 2010 and 2020 Targets

112. The practice of harnessing the power of the wind is not a new one. Throughout history, wind power has been used by human society for a variety of purposes from the development of ocean going transportation and trade, to land irrigation, drainage and food production. The modern development of wind turbine technology for electricity generation from wind power has been ongoing since the 1950s. While the technology was slow to develop at first, the energy crises of the 1970s led to an upsurge in the research and development of alternative forms of energy which were not dependent on fossil fuels.

113. The development of wind technology was further boosted by the growing environmental movement of the 1970s and 1980s. This added to the impetus for the development of clean sources of energy. In Scotland, trials of wind turbines for generating electricity were underway by the late 1950s. However, the discovery and exploration of North Sea oil and gas reserves in the 1970s meant that the development of wind technology in Scotland and the UK abated.

114. The cause of wind power development was taken up by other countries anxious to establish energy independence from fossil fuel sources. By the late 1980s several European countries, led by Denmark, had moved forward significantly in developing and

producing wind turbine technology.

115. One of the important questions raised during the inquiry has been in relation to the development of onshore wind in Scotland and its potential role in meeting the targets set by the Scottish Executive. The answer to this question depends, in large part, on the current market support system for the development of onshore wind.

116. Scotland is already starting from a high level in the development of renewable electricity generation thanks to the hydro-electric projects in Galloway in the 1930s and the Highlands in the 1940s, 1950s and 1960s. Scotland currently derives about 2000MW or 11% of its installed capacity from hydro-electricity¹⁹. Given this position the potential for further large scale development of hydro-electricity in Scotland is limited. Scottish and Southern Energy stated in evidence to the Committee that "with the exception of the proposed 100MW hydro-electric scheme at Glendoe, the potential for large-scale hydro generation in Scotland has largely been exhausted"²⁰.

117. For Scotland to meet the target of 18% renewable electricity generation by 2010 it will require approximately an additional 1300MW of installed capacity from renewable sources. In its evidence to the inquiry the Scottish Renewable Forum²¹ (SRF) stated that most of this balance will be met by the development of onshore wind farms. This is a view supported by the Scottish Energy Environment Foundation (SEEF)²². Indeed SEEF went further by suggesting that the 'aspirational' 40% target by 2020 could be met and that the largest proportion of it (possibly up to 85%), will be met by onshore wind development. This equates approximately to 4890MW of installed capacity, which does not take into account any potential gain from demand reduction²³.

118. According to SEEF this is mostly due to the fact that Scottish and UK energy policy has "placed the development of renewable energy sources firmly in the hands of the market with no strategic overview of what the market will deliver in terms of build-rate, capacity or technology mix"²⁴.

119. The Scottish Energy Environment Foundation (SEEF) describes itself as "an independent organisation set up to create an internationally significant centre of excellence in energy and related environmental policy. Its aim is to provide authoritative advice on energy and the environment for demand and supply issues, as well as contributing to the development of a balanced energy policy within the UK"²⁵.

120. Scottish Power stated in written evidence to the inquiry that a large proportion of the energy mix required to meet the 40% target will need to come from other renewable sources besides onshore wind²⁶. The submission goes on to state that the potential for offshore wind development in Scotland is low due to a lack of appropriate offshore sites close to areas where grid access is, or is likely to become, available. This will require the development of market ready levels of other renewable sources such as wave, tidal and biomass. However, Scottish Power suggests that this is, at the moment, an unlikely prospect. It submits that there "does not yet exist a coherent and functioning mechanism to ensure that the most promising technologies...can move through the development cycle to full commercialisation"²⁷.

121. As previously stated in paragraph 97 the Renewables Obligation should, in theory, bring forward a mix of renewable generating sources as it is intended to be technology

neutral. In practice, however, this seems far from the case. The evidence received by the Committee suggests that, under the present market system, onshore wind will play the major part in meeting the renewables targets over the next decade. This is due to the fact that wind technology is a mature technology with off the shelf wind turbines providing an affordable, low-risk and easily designed option to allow the generating companies to meet their targets under the RO and ROS²⁸. Also, the dedicated market support structure provided by ROCs²⁹ ensures that onshore wind is commercially viable within the UK energy market.

122. The public debate over the use of onshore wind technology is set to continue for the foreseeable future with strongly held views - both for and against - regularly being expressed through the media. This has led to a general concern, expressed by several witnesses to the inquiry, that the small but vocal opposition to onshore wind farm development may have a wider negative impact on the general public's opinion of the renewable energy sector as a whole.

123. It is clear from the evidence taken that the Scottish Executive will meet its short term target of 18% of electricity from renewable sources by 2010. However, this increase will come almost entirely from onshore wind generation, which raises a number of major issues in relation to the future of renewable energy in Scotland.

124. As things stand, if the Executive's 'aspirational' target of 40% by 2020 is to be met, it will be almost entirely through onshore wind power. This is neither sustainable nor sensible.

Offshore Wind Farm Development

125. The development of wind farms in relatively shallow coastal waters is another potential source of renewable electricity generation. Throughout Europe, offshore wind farms form a major part of the generation capacity from wind sources.³⁰ The main advantage of offshore wind over onshore wind farms is that, given the right coastal conditions, it is possible to construct much larger farms than are normally found on land.

126. Scotland's first offshore wind farm, Robin Rigg, is currently under construction in the Solway Firth. Once operational this wind farm will produce approximately 180MW of electricity³¹. The potential for offshore wind to contribute to the UK's emission reduction targets is considerable. However, the Committee has heard in the evidence that, currently, the bulk of the UK's usable offshore wind resource lies in England and Wales³². There are two main reasons for this.

127. Firstly, the coastal shelf around England and Wales is better suited to the construction of offshore wind farms as shallow waters extend for several miles off the coast³³. In Scotland, for the most part, the coastal shelf drops away into deeper waters closer to the coast. This makes the economic development of offshore wind more difficult. It has, however, been pointed out by several witnesses that given Scotland's long experience with the construction and development of the North Sea oil and gas infrastructure, the development of offshore wind farms in deeper waters should not present an insurmountable problem.

128. Secondly, the development of offshore wind in Scotland is likely to be hampered by

the weakness of the transmission grid. Regardless of the amount of suitable development sites off the coast of Scotland, the vital issue for the development of large scale offshore wind is ready connection to the grid. Part of the problem for offshore wind development is that, like onshore wind, many of the best offshore sites in Scotland occur at points where the Scottish grid is weakest. In order for Scotland to harness its offshore wind potential, upgrading and strengthening the transmission grid will be essential. Issues of grid capability and maintenance are discussed in detail later in this report.

129. Offshore wind may also have the advantage of being relatively visually unobtrusive. Many witnesses opposed to the development of onshore wind farms cited the potential for the development of offshore wind farms as an alternative. Several submissions to the inquiry suggested that the present North Sea oil and gas infrastructure could be adapted for use by the offshore wind farm sector. Much of the support expressed for offshore wind was based on the fact that it would not be as visually obtrusive as onshore wind farms and so would be less likely to have the allegedly negative impact on the rural economy. This argument is not necessarily borne out by experience to date. It should be noted that, as part of the consent process for the Robin Rigg project mentioned above, the Scottish Ministers received 491 representations from organisations and the public³⁴. Of these 436 cited the potential impact on visual amenity and 237 cited the potential impact on tourism as objections to the project. As part of the granting of consent for the development the Scottish Ministers established the Robin Rigg Monitoring Group (RRMG) whose role is "providing a schedule of potential impacts to be monitored for the approval of Scottish Ministers"³⁵.

130. The development of large scale offshore wind farms would also have to consider the potential impact on industries such as fishing and maritime shipping. Navigational routes and marine habitat issues would also need to be considered carefully. Scotland's planning laws have not been tested in this regard; the Robin Rigg development was granted permission by the Scottish Ministers under section 36 of the Electricity Act 1989. As all of the relevant cabling and substation development of the Robin Rigg project will occur in Cumbria, it was dealt with under English planning regulations. No Scottish local authority was formally involved in the granting of approval for this project.

131. Despite the problems of finding suitable marine sites for the construction of offshore wind farms, coupled with problems in connection to the national grid, it is clear from the evidence that under the right conditions offshore wind could contribute to meeting Scotland's renewable targets. In some locations this would have the added benefit of overcoming many of the public objections encountered by onshore wind farms. The development of offshore sites in Scotland would not only add to the mix of renewable sources of installed generating capacity, it would also be a positive sign that all of Scotland's various renewable energy resources were being exploited.

Intermittency and Security of Supply

132. One of the major concerns expressed in the role of large scale wind farm development in Scotland is the issue of intermittency of supply. In order to maintain a stable electricity supply the transmission network (the national grid) must remain balanced. Put simply, the levels of electricity being put onto the grid must be balanced with the amount of consumption taking electricity off the grid. The grid operators (Scottish Power & Scottish and Southern Energy in Scotland and National Grid Transco in England

and Wales) have a statutory duty to ensure the transmission grid remains balanced and operational in order to secure supply³⁶. This is achieved by managing the amounts coming on to and off the grid at any one time.

133. On the consumption side there are two main sectors: commercial, and domestic customers. Most large scale commercial consumers of electricity have agreements with the grid operators in relation to their consumption levels at any given time. This allows the grid operator to vary the power they consume and so help balance the grid. On the domestic side the grid operators have very little control over how much electricity is consumed. However, the domestic market is relatively predictable in its consumption given the time of day and year and the weather conditions. The grid operators therefore have a very good idea of when 'peak' levels of domestic consumption will occur and can respond accordingly by ensuring that sufficient levels of electricity are generated when needed.

134. On the generation side, the grid operators have the ability to vary the level of electricity being generated by bringing more generating plants onto or off the grid. The speed with which this response can be activated depends on factors such as the consumption demand at the time and the types of generating plant available to step up production. Some forms of generation such as hydro-electric can react very quickly from a 'standby' position. Other forms of generators, such as coal and gas plants, can only react more slowly, while nuclear has no short-term reactive capability. The normal method of managing this process is by having a certain amount of 'spinning reserve' generation on standby for when it is needed. Spinning generation is the process of running a power plant to generate electricity but not having it connected on to the grid. The benefit of this system is that, at peak times, such spinning reserve can be connected to the grid quickly without any long start up time, so allowing peak demand to be met.

135. The drawback of spinning reserve is that generating plants need to be operating on the basis that they may be needed at short notice but for most of the time are generating power for no other purpose. For the most part these are the stations which consume fossil fuels such as coal and oil. Therefore, the practice of having stand-by spinning reserve increases the emissions of carbon dioxide and other gases.

136. Currently Scotland is a net exporter of electricity, mainly to England and Wales. As of 2001, 37% of Scotland's electricity was generated by nuclear power, 53.3% generated from conventional fossil fuels (coal 32.3%, oil and gas 21%), 8.7% from hydro-electric and 1% from other sources such as wind power and landfill gas³⁷.

137. One of the arguments put forward by those opposed to the wide scale use of wind power is that, as a generating source, it is an intermittent supply and so is far less reliable and predictable. Wind turbines can operate only within a certain wind speed range (between 4 m/s³⁸ and 25 m/s)³⁹. If the wind speed is too low the blades will not be turned and the turbine will not generate electricity. If wind speeds are too high the turbine will shut down automatically to prevent damage being caused. If wind farms were supplying a large percentage of the power to the grid at any one time, and weather conditions suddenly became unfavourable, a situation could arise where several large generating farms go 'offline' in a relatively short period of time. This in turn would lead to a sudden fall off of power across the transmission grid.

138. It is worth noting however that a situation where wind speeds across the entire land mass of Scotland would suddenly and dramatically fall, from a level where all onshore wind farms are generating electricity to a level where they are not, would be very rare indeed. Any such scenario would also be predictable using modern methods of meteorology.

139. In such circumstances, to keep the grid balanced and maintain supply, the grid operators would have to either try to reduce consumption by getting commercial customers to reduce their demand levels, or compensate for the power loss by bringing additional spinning reserve on to the grid. The latter is the more likely option in this scenario as it can be difficult and expensive for commercial customers to react quickly to the minute-by-minute needs of the grid.

140. The greater the percentage of electricity generated from an intermittent source, the greater the amount of spinning reserve plant required to be on standby for back-up purposes. Most spinning reserve in the UK is generated from fossil fuel sources. Over-reliance on wind could lead to the ironic situation that the greater the proportion of Scotland's electricity generated from intermittent sources, the greater the need for carbon-producing spinning reserve to back it up. The ultimate result of this situation is that carbon emissions from fossil fuels would increase rather than decrease. Those opposed to the generation of electricity from large scale wind farm development cite this as the major reason against the use of onshore wind farms. They argue that the requirement for spinning reserve means that, in practice, wind power is not necessarily a 'carbon neutral' power source since, while wind powered generation itself does not emit carbon dioxide (CO₂), the standby generation needed to back it up does produce emissions, using current equipment.

141. As things stand, if the current 2020 target is achieved, taking for example the energy modelling system put forward by SEEF as a guide, anything up to 34% of Scotland's installed generating capacity could be provided by onshore wind farms (i.e. 85% of the 'aspirational' 40% target = 34%). In a situation where up to a third of Scotland's installed capacity is expected to come from intermittent renewable sources such as onshore wind, the need for the development of a large scale storage system for electricity is vital for grid stability and security of supply. This percentage increases even further depending on how other intermittent renewable sources, such as wave generation, contribute to Scotland's overall generating capacity.

Accommodating Intermittency

142. If wind were to supply more than 20% of electricity generation, methods of dealing with intermittency would have to be developed. The Committee received evidence that there are two main ways in which this can be achieved. One is to upgrade and reinforce the national grid to protect it from sudden changes in power level which may unbalance the system. The second method is to develop a means of storing electricity produced at times of peak generation, which can then be distributed at times of peak demand. This would ease the strain on the grid network and thereby improve stability and guarantee security of supply.

143. This report deals with upgrading the Grid at paragraphs 253 to 269 below.

Storing electricity

144. The practical methods of achieving an electricity storage system fall into two categories, namely:

- hydro-electric pump storage; and
- hydrogen cell technology.

145. Scotland's extensive network of hydro-electric plants provides an opportunity to deliver a stabilising system for the grid network through the use of pump storage. Pump storage operates on the principle of pumping water uphill into mountain reservoirs during the periods of minimum demand when costs are lowest, releasing it downhill to generating stations at peak periods. Electricity generated from wind farms at times of low demand across the grid could be saved via pump storage, and could then be used to provide a reserve to the grid at peak demand times. This would be very beneficial if it coincided with a period of intermittent supply caused by a fall in generation from wind farms at times of peak demand.

146. In the debate over the intermittency issue of wind farms, the example most often quoted is that of the cold, windless winter day with high pressure sitting over Scotland. This would result in a high demand for electricity for lighting and space heating at a time when the wind resource is at its lowest and onshore wind farms are not generating enough electricity. Utilising the existing pump storage system would help to ease the intermittency issue in the short term.

147. Witnesses who gave evidence to the Committee in support of wind farms refuted the argument that such a situation would develop. They argued that while some parts of Scotland may have little or no wind at peak demand times, it would be almost impossible for all the wind farms across the country to stop generating because of calm conditions. In fact, witnesses in favour of onshore wind stated that the greater the number of wind farms spread throughout the country, the smaller the potential impact from still wind conditions.

148. However, given Scotland's electricity needs, it is clear that pump storage would not be capable of acting as a reliable grid stabilising system on its own. Expansion of pump storage facilities would also have environmental consideration. For example in areas where no suitable natural geographical conditions exist, man-made dams required to be constructed. To ensure the long term stability of the grid it will be necessary to develop wide scale hydrogen storage systems in Scotland.

149. Hydrogen storage works on the principle of storing electricity generated by intermittent renewable sources (e.g. onshore wind) at times of low demand, through the capture of hydrogen. This hydrogen can then be used in a chemical reaction to generate electricity for supply onto the grid at times of peak demand. The storage capability of such a system would only be limited by engineering and design issues.

150. Hydrogen is a highly volatile element which must be used in a safe manner. The primary issue in relation to the development of a hydrogen storage system relates to the infrastructural and commercial viability of the required technology. The Committee has heard that several other countries such as Iceland and Singapore are active in the development of hydrogen technology⁴⁰. The development of hydrogen storage systems

also holds great potential in relation to the main energy consuming sectors, namely transport and space heating. Electricity generation only accounts for 20% of all energy consumption in the UK. The vast bulk of energy consumed in the UK is used in the non-electricity generating sector. Consequently this is also the major contributor of climate changing gas emissions.

151. The potential to tackle the problem of reducing the UK's climate changing emissions by adopting integrated policy development in the areas of hydrogen storage, public/private transport and domestic/commercial space heating is substantial⁴¹. The UK Government must address these important areas if meaningful progress is to be made in arresting the causes of climate change.

152. Hydrogen storage development is, however, a leading edge technology and the feasibility of developing a large scale storage system in the short to medium term must be explored.

153. During the Committee's case study visits to both Aberdeen and Denmark, members heard evidence about the potential for hydrogen development. While visiting the Aberdeen-based offices of the commercial fuel cell company SiGEN on 10 May 2004, members heard of the need to develop a dedicated hydrogen strategy for Scotland which would create a focused timeline and context within which the hydrogen development industry could operate. SiGEN believes this will be vital for the development of hydrogen as an integral part of the development of the Scottish renewable sector.

154. During the Committee's case study visit to Denmark on 16 February, members met with Mr Hugh Sharman from the international energy consulting company Incoteco AsP⁴². Mr Sharman informed members of Incoteco's work on proposals for the development of a wide scale hydrogen storage system to act as a balancing system for the electricity transmission grid in the western Jutland area of Denmark. This work is being carried out because ELTRA⁴³, the transmission operator in the Jutland area, is seeking to develop a system to store surplus electricity production as a way of balancing its transmission grid. Incoteco is now working in partnership with other companies to develop its proposals for the construction of a mass hydrogen storage system for western Jutland.

155. Clearly, the development of hydrogen technology has major potential for the growth of the renewables sector as a way of countering intermittency. This potential must be explored and exploited to the full to underpin the development of Scotland's renewable economy.

RENEWABLES AND THE PLANNING PROCESS

156. The ability of the planning process in Scotland to cope with the growing renewables sector has been one of the recurring themes of this inquiry. The current debate on the subject of planning has been driven by the recent increase in the number of applications for the constructions of onshore wind farms in Scotland. However, there is a difference between the public perception about the level of wind farm development due to the increase in the number of applications and the actual number of projects that receive approval. Scottish and Southern Energy estimates that, under the present planning system

in Scotland, for every eight applications which are submitted for the development of a wind farm, only one is successful⁴⁴.

157. However, Scottish Power sounded a note of caution in its evidence to the Committee on the estimate of a 1 in 8 success rate for onshore wind farm applications. Alan Mortimer of Scottish Power said: `the figure of one in eight relates to the early development stages. Projects drop out of development for all sorts of reasons, which do not only involve planning. I am sure that the success rate from planning application to planning approval is an awful lot better than one in eight. Projects drop out even before they reach the application stage, as developers investigate and find an environmental or technical issue or fail to sign up the landowner, for example⁴⁵.

158. In its submission to the inquiry the Scottish Executive indicated that there are about 16 onshore wind farm developments which have received planning approval and should come on stream over the next 12 to 18 months in Scotland. These projects total some 692MW of installed capacity⁴⁶. According to the British Wind Energy Association (BWEA) there are currently 21 wind farm projects (over 1MW) with grid connection in Scotland, with a combined installed capacity of about 255MW⁴⁷. The BWEA estimates a further nine wind farms, with an installed capacity of about 230MW, are expected to become operational in Scotland by the end of 2004⁴⁸. These figures would suggest a near three fold increase in the installed capacity of onshore wind farms in Scotland by late 2005. All the evidence received by the inquiry would suggest that, if the current market system remains unchanged, this growth rate will continue over the next decade as power generating companies seek to achieve the targets set by the Executive.

159. On 13 January 2004 the Committee took evidence from COSLA. During its evidence COSLA called for the development of a national strategic planning framework for Scotland to oversee the strategic development of renewable energy⁴⁹. While the bulk of applications to date have related to the development of onshore wind farms, COSLA argued for a strategy which could encompass the development of all renewables energy sites in Scotland⁵⁰.

160. The Deputy Minister for Enterprise and Lifelong Learning, Lewis Macdonald, stated in evidence that while the planning system is kept under review, the current planning guidelines are robust enough to deal with the expansion of the renewables sector. This view is not shared by many of the local authorities from which the Committee has taken evidence.

161. Planning is a matter devolved to the Scottish Executive. From the evidence taken to date it would appear that much of the experience of members of the public and local authorities in dealing with the developers of the renewable sector comes by way of the public planning system. Planning policy in Scotland is set out in the Executive's most recent guidance document for planning, NPPG6⁵¹. This guidance is further supplemented by the publication of a planning advice notice on renewable energy technology, PAN45⁵². In April of 2004 the Executive published the first National Planning Framework for Scotland. This framework is intended to "guide the spatial development of Scotland to 2025"⁵³. These documents form the core of the Scottish Executive's planning policy in relation to the development of the renewable sector in Scotland.

162. In addition to evidence from COSLA, the Committee received both written and oral

evidence from Argyll and Bute Council and written submissions from Aberdeenshire Council and Fife Council. Members of the Committee also met with representatives of both Orkney Islands Council and Highland Council during case study visits. It is clear from the evidence received that many Councils are dealing with the same problems in relation to the renewable energy sector. For most, the current issue is the development of onshore wind farms and the burden this is placing on their planning systems.

163. All the Councils expressed the opinion that planning guidance in Scotland was not sufficiently robust to allow them to deal with the volume of planning applications they currently face in relation to onshore wind farms. One commonly expressed view was that Councils have no clear guidance as to what proportion of the Scottish national renewable targets their area should seek to deliver. This has led to a concern that some local authorities are bearing a disproportionately large amount of the development of renewables by virtue of the volume of proposed onshore wind farms in their authority area. This can have a negative impact on the planning resources of the council in question as the time to process an application for an onshore wind farm can increase, depending on the size and location of the proposed farm and the number of objections received from the public.

164. During the Committee's case study visit to Orkney, representatives from Highland Council told members of the Committee that the Council now regularly received upwards of 1000 public objections to the erection of anemometer masts in the Highland area. An anemometer is a device used to record the average speed and prevailing direction of the wind at any given site. These masts are erected to determine whether a site possesses suitable conditions for the construction of a wind farm.

165. Concern has also been expressed about the capacity of local authorities to deal adequately with the volume of planning applications for onshore wind farms. The Committee heard evidence that planning departments are finding it difficult to cope with the increase in the volume of wind farm applications and the lack of a coherent national strategy was leading to concerns such as the cumulative impact of wind farm development in areas where two or more local authority boundaries meet.

166. The Committee has noted that the Executive's newly published National Planning Framework for Scotland states that "...landscapes evolve continuously in response to climatic, economic, social and technological change. The effect on landscape character will be an important consideration in decision-making on renewable energy developments"⁵⁴.

167. Delays in the planning process also lead to constraints on new renewable developments. Currently, any developer wishing to seek access to the grid for the development of a wind farm, or any other renewable resource, can seek to secure access to the grid before being granted planning permission for the development. Given the limited space currently available on the transmission network in Scotland, this is normally the first priority for a developer. However, as delays in the planning system mount, this can give rise to a situation where grid access is restricted by developers who have secured access from the grid operator but, because their planning applications are delayed in the system, are not yet supplying electricity to the grid but have effectively sterilised the capacity they have been allocated. This logjam can, in turn, slow the development of both wind and other renewable projects as it becomes difficult to secure financial backing for a project

unless the developer has secured the necessary grid access.

168. This point was highlighted during the Committee's visit to the newly established European Marine Energy Centre in Orkney. The Centre has secured up to 7MW of connection access to the grid to allow for the testing of marine wave devices for the generation of electricity. However efforts to expand this are currently being slowed by the limited space available on the grid due to its weakness in northern Scotland and the Isles. This is due to the fact that much of the available space on the grid has already been allocated to other developments which have yet to become operational and to start generating electricity. The allocation of additional connection space will require upgrades to the grid in order to increase its capacity. This supports the evidence received from groups such as ALIenergy and the main power companies⁵⁵.

169. The planning system is further complicated by the split of responsibility for final decision-making between the Scottish Ministers and local authorities. The Electricity Act 1989 is a piece of UK legislation which, amongst other things, governs the planning approval for the development of electricity generating stations developments above 50MW⁵⁶. Section 36 of the 1989 Act allows for UK ministers to make the decision on granting or refusal of planning permission for the development of a wind farm of 50MW or above. The executive discharge of this section in Scotland has been transferred from the UK Government to the Scottish Ministers.

170. Many of the proposed wind farms in Scotland over the next decade are expected to be on or above 50MW in generating capacity. This places local authorities in a difficult position both in terms of planning policy and resources. The planning department of a local authority will be required to carry out the planning process for all wind farm development falling within their area, regardless of the generating size of the farm in question. Once the planning process is completed the local authority makes a recommendation to the Scottish Ministers on whether or not to grant permission for developments of wind farms over 50MW. This puts the local authority in the position of being seen not to have ultimate control of planning system in its own area. It can also be seen to be undemocratic by local communities who may oppose the development, especially if the Scottish Ministers grant permission to a wind farm which the local authority has recommended they should refuse. This sentiment was evident from the evidence received by the Committee from members of the public. For example, in his written submission to the Committee Dr Brendan Hamill stated that, on the planning system for wind farms in excess of 50MW:

"the Scottish Executive may be seen to be steamrolling applications through the planning process in an attempt to meet targets which are unachievable. [As a result] local authority planning procedures can be by-passed when any wind project is over 50MW. This encourages proposals for large wind farms from developers. Locals are being denied a local forum for discussion where they can air their views regarding such proposals"⁵⁷.

171. This point of view was also expressed to the Committee by local authorities. During the Committee's evidence taking session in Campbeltown on 20 January, the Director of Development Services for Argyll and Bute Council, Mr George Harper, stated that:

"the threshold of 50MW does not make sense to me as a professional or to my members. It

takes away the democratic edge and accountability from applications"⁵⁸.

172. In any system of government it is necessary to balance the needs of local communities against the wider needs of what is in the strategic interest of society as a whole. National government must be able to ensure that the national interests are met. As the same time local government must be in a position to protect what it justifiably sees as the local interests of the community it serves. Striking the balance in this equation can often be a difficult and controversial task.

173. According to the submission from the Scottish Executive, as of early 2004 there were about 90 proposed wind farm developments either planned or seeking approval in Scotland⁵⁹. Of these about 40% were 50MW or above. However only 15% of these proposals were in excess of 100MW. It is clear to the Committee that, given the rate of development of the renewable sector in Scotland today, the threshold of 50MW for planning approval on onshore wind farms, as established by section 36 of the Electricity Act 1989, is out of date. The 1989 Act allows the Secretary of State for Trade and Industry to amend the 50MW limit by way of secondary legislation in the UK Parliament. **This limit should be reviewed.**

174. One of the major disadvantages of the current planning system in relation to renewables is the uncoordinated approach often adopted by different developers to the location of proposed wind farms. During the Committee's case study visit to Orkney members were told that the 'scattergun' approach taken by various developers when choosing sites for proposed wind farms was having a negative impact on overall planning policy. The Highland Council delegation cited anecdotal evidence of a case in Caithness where a developer applied to develop a wind farm on a site which the Council did not consider as suitable as others in the area. However, as there was no actual reason to turn down the application on national planning grounds, permission was granted. This meant that another wind farm application on a nearby site, which the Council considered more suitable but which was lodged later than the first, had to be refused because of opposition to the cumulative affect of having two large wind farms located in close proximity to one another. This example highlights what the Council sees as the need for a more detailed development and planning strategy from the Scottish Executive in relation to renewables.

175. In its written submission to the Committee, Aberdeenshire Council echoed this sentiment by calling for the Executive to develop "a more robust and clear planning framework...for large scale wind and hydro developments"⁶⁰.

176. The Royal Town Planning Institute in Scotland stated in its written submission that:

"as with many of the NPPG series, national [planning] policy is based on criteria which local authorities are expected to apply in their statutory development plans, particularly structure plans, to define preferred areas for renewable energy development. Many structure plans continue to opt for a criteria approach which means that there is no clear vision for the pattern of renewable energy, particularly wind farm developments across Scotland"⁶¹.

177. The Executive has included renewable energy as part of the new National Planning Framework (NPF) for Scotland. The NPF estimates that Scotland will require 2000 - 2500MW of renewable generating capacity by 2020. This would represent a build rate of

about 120 - 150MW per annum⁶². The NPF says that the National Grid should "take account of the opportunities for unlocking the potential of additional renewable energy sources." However, it does not refer to the issue of *preferred development zones* for renewable energy, an issue raised in the submission from the Royal Town Planning Institute as a key issue⁶³.

178. COSLA also reflected the views of local authorities in its evidence to the Committee by seeking the development of a dedicated Scottish renewable energy strategy. This could bring together issues of local planning and democracy with an approach to decide how all renewables technology are implemented⁶⁴.

179. The major power companies in the Scottish market, Scottish Power and Scottish and Southern Energy, were however more cautious about the benefits of a dedicated Scottish renewable energy strategy. In his evidence to the Committee, David Sigsworth of Scottish and Southern Energy stated that:

"We have heard a spectrum of views about how supply companies will fulfil the challenge that has already been given to us to develop renewable energy. You keep asking us, "Are you going to do things here or there?" The Parliament has already set the hurdle for our customer supplies. There must be a certain level of renewable energy at certain dates, but currently the Government in Scotland and-to an even greater extent-the Government in England are not facilitating renewables developments at the rate that is required for us to do what is required of us. There is a conundrum and we should consider whether writing a policy would help us"⁶⁵.

180. Susan Reilly of Scottish Power agreed for the need to ensure specific Scottish issues are addressed but expressed caution about the development of any Scottish renewable energy strategy which might place additional burdens on Scottish generating companies, disadvantaging them in relation to their competitors south of the border. In her evidence she stated:

"We agree that we need to pay attention to certain Scottish issues, which we have mentioned. In particular, as we move into the Great Britain-wide trading system, we must be careful that, in comparison with generators elsewhere in the country, Scottish generators are not discriminated against and that renewables are not discriminated against"⁶⁶.

181. It is clear from the evidence received by the inquiry that the current planning system in Scotland is struggling to cope with the accelerating pace of renewable energy development. Despite recent guidance on planning in Scotland such as NPPG6, PAN45 and the National Planning Framework for Scotland, weaknesses in the planning system still exist in relation to renewables. Both developers of renewable energy projects and members of the public have expressed frustration with the way the planning system is coping with the development of renewables. Local authorities have also expressed concerns over the burdens which the renewable sector is placing on them, especially in relation to onshore wind farm development. Part of the problem is that, for the most part, consultation on the development of a wind farm rarely commences until just before or after the lodging of a formal application for planning approval.

182. Several witnesses also expressed concern over the issue of planning fees in relation to

those wind farm applications which come under section 36 of the Electricity Act 1989. This requires planning consent for proposed electricity generating stations in excess of 50MW to be made by the Scottish Ministers as opposed to the local authority in question. Both COSLA and the Scottish Renewables Forum highlighted that currently the planning department of a local authority carries out all of the required work on an application for a wind farm. However, under the terms of the 1989 Act, the planning fee for applications above 50MW goes to the Scottish Ministers, as it is they and not the local authority in question, who grants or refuses permission⁶⁷. This gives rise to a situation where a local authority must bear all the costs associated with processing the application from its own resources, without receiving a fee from the developer. In its submission to the inquiry Highland Council stated that the typical planning fee for a proposed wind farm up to 50MW is £11,000, depending on the area of the land the farm will cover⁶⁸. For applications above 50MW, local authorities still carry out the same planning procedure in order to be able to make a recommendation to the Scottish Ministers, but do not receive a fee. So the cost of site visits and environmental assessments have to be met by the Council, placing additional pressure on the planning system by using up resources.

183. In evidence from the major power companies there was agreement on the issue of planning fees in relation to wind farms both above and below 50MW generating capacity. Alan Mortimer of Scottish Power told the Committee that a planning fee of about £10,000 was "nothing like enough to cover local authorities' resource requirements to deal with an application as it moves through the process"⁶⁹. Scottish Power recommends an increase in the planning fee for proposed onshore wind farms to enable the planning process to deal with them more quickly.

184. In evidence to the inquiry the Deputy Minister for Enterprise and Lifelong Learning stated the Executive's belief that current Scottish planning guidance is sufficient to deal with the development of the renewable sector in Scotland⁷⁰. The Deputy Minister pointed out the ability of local authorities to consider location issues for renewables as part of development of their structural plans for their area. In his evidence to the Committee the Deputy Minister for Enterprise and Lifelong Learning accepted the point about the planning fee in relation to section 36 of the 1989 Act. The Minister stated that the Executive is "happy to consider that point and whether there is a way in which we [the Executive] can satisfactorily address that concern"⁷¹.

185. It is clear that the planning guidance from the Scottish Executive is inadequate to deal with the current pace of onshore wind farm development in Scotland. The Executive must take an active lead and develop a national strategic framework for wind farm applications and engage with local authorities on how to deliver this within their area. The Committee believes the current Executive review of the planning process provides an ideal opportunity to achieve this.

186. The development of such a framework should also seek to address the wider development of the renewable sector in Scotland. This may include arriving at agreements with local authorities as to their level of contribution in meeting Scotland's renewable targets for 2010 and 2020. Part of any framework could also include a requirement for pre-application consultation between renewable developers, local authorities and other interested parties as well as a requirement for developers to consult with each other on applications for proposed renewable projects in a given area. This may assist in addressing some of the issues we have highlighted in relation to the development of onshore wind

farms.

187. In relation to the issue of planning fees for proposed electricity generating developments coming under section 36 of the Electricity Act 1989, **the Committee recommends that the Scottish Executive examines the level of the planning fee for proposed wind farm developments to ensure it is adequate. The Committee also recommends that the Executive establishes a system which would allow local authorities to keep, or to be reimbursed for, the value of the planning fee for all renewable developments coming under the provisions of section 36 of the 1989 Electricity Act.**

THE DEVELOPMENT OF MARINE TECHNOLOGY IN SCOTLAND

188. Over the course of the inquiry the Committee has heard from many witnesses who have lamented the fact that Scotland allowed the advantage it held in the development of wind technology some 25 to 30 years ago to slip to competing economies such as Denmark. Many witnesses have noted how a small economy such as Denmark has capitalised on the development of wind technology to increase its production of domestic energy generation and, at the same time, deliver greatly for the Danish economy in terms of manufacturing jobs, intellectual capital and technology exports. Figures from the Danish Energy Authority show that, in 2002, Denmark exported 14.6 billion Danish Kroner worth of renewable technology (£1.3 billion) and 81 million Danish Kroner in renewable energy consultancy services (£740,000)⁷². Wind energy is expected to become Denmark's biggest export earner over the next five years.

189. Over the last two decades Scotland has established an impressive base in the development of marine technology in terms of research and application development. Many witnesses have expressed the view that it is vital that Scotland uses the lead it has developed in the field of marine technology to the maximum benefit both for the Scottish natural environment and the Scottish economy. It is also clear from the evidence received that if Scotland is to meet its renewable energy targets it must expand its developing renewables sector into other areas apart from onshore wind. The marine sector appears to hold out the best prospect for Scotland to achieve its twin objectives of environmental protection and economic development

190. The potential economic benefits of marine technology for local communities are indicated in the National Planning Framework for Scotland which states that "coastal areas will play a key role in Scotland's bid to become a world leader and exporter of marine power technology"⁷³.

191. Scotland is by no means the only country to see the potential for economic success in the 'green jobs' revolution. The Committee has already heard from witnesses such as the Scottish Energy Environment Foundation about how other European countries, particularly Portugal, are actively trying to gain a lead in the development of marine renewables. The Portuguese government has established a subsidised feed-in tariff for the first 20MW of electricity generated by marine resources of €225 per MWh.⁷⁴ This is substantial considering the fact that, under the present Renewable Obligation Certificate, the subsidy for onshore wind in the UK is the equivalent of approximately €90 per MWh.⁷⁵

192. The Deputy Minister for Enterprise and Lifelong Learning, Lewis Macdonald, maintained in evidence that Scotland would continue to remain competitive against Portugal:

"Portugal is keen to be in the game and is working hard at it. The country has a good natural resource, but it is nothing like as good as ours. One university there has a active interest in marine energy, but we have four universities with an active interest"... "I am not aware that Portugal has test facilities that would compete with ours"... "I do not accept that Portugal is ahead of us"⁷⁶.

193. This is a clear indication, however, that Scotland cannot afford to take for granted that the development of a thriving marine sector is guaranteed based on the lead we currently hold. **Government in Scotland and the renewables sector must learn the lesson from wind technology and put in place any additional measures required to ensure that Scotland achieves the ambition of becoming a leading economy for the development and production of marine renewables.**

194. Scotland currently has several advantages on which to build a solid platform for the development of a thriving marine renewable sector, both in wave and tidal stream technology. Both these areas of marine technology also have the potential to play a significant role in helping Scotland to meet the renewable targets it has set.

Wave Power

195. The first of the two main areas of marine technology currently being developed is that of wave power. While there are many various forms of wave generator under development, all work is based on the principle of harnessing the kinetic energy of wave motion to generate electricity. This electricity is then brought ashore and transmitted via the national grid.

196. Wave motion is powered by the movement of wind currents across the surface of the ocean. So, just as with wind technology, wave power can suffer from an intermittency problem. In a Scottish context, wave generators have to operate in a marine environment which can vary from very calm 'millpond' conditions to the extreme of a 'once a century storm'. Co-incidentally this can mean that the times when wave generators may be unavailable to supply power, either because it is too calm or the seas are too heavy, can coincide with the same variables for onshore and offshore wind power.

197. While these conditions are the extreme ends of the scale and are therefore rare, they must be considered when assessing the potential for wave power to contribute to meeting Scotland's energy targets. Nonetheless, it is estimated that Scotland has the largest natural resource from wave power of any country in Europe. Much of the evidence received by the Committee points to the enormous potential of wave power to supply electricity. In its submission to the Committee, Wavegen Ltd stated that the potential energy from wave power around the shores of the UK is greater than the whole of the UK's electricity consumption⁷⁷.

198. This is a view supported by Dr Robin Wallace of the Institute for Energy System based at the University of Edinburgh. In his written and oral evidence to the Committee Dr

Wallace pointed out that Scotland has some of the best wave resources in the world⁷⁸.

Tidal Stream Power

199. The other main form of marine renewables is that of tidal stream generation. Tidal stream generation operates on the principle of using the kinetic power generated by the ebb and flow of tides to produce electricity. Tidal patterns are driven by a complex combination of gravitational forces (the Earth's gravity as well as that of the moon) acting on the body of water composing the oceans and other environmental factors. For this reason, tidal flow has two major advantages over wave generation. Firstly, as it is not dependent on the atmospheric conditions at any given time, it provides a constant source of energy. Secondly, as tidal and gravitational patterns can be very accurately calculated by modern science, it is possible to predict tidal patterns and their resultant energy generating potential, for a very long time into the future (i.e. centuries). This has the benefit of allowing firm forward planning which helps to reduce the problem of intermittency of supply.

200. In relation to both the main forms of marine renewables, the Committee has heard from witnesses that the key factor in the successful development of this sector is in producing 'market ready' technology as quickly as possible. As already outlined in the report, currently the only market-ready renewable technology available for widespread use is that of onshore wind generation.

Making Marine Renewables Market-Ready

201. Many of the witnesses who have given evidence to the Committee on marine renewables have stated that the most important factors to address in the development of the marine sector are getting the technology through the development cycle quickly and providing a suitable market support structure to allow marine technology to compete effectively in the energy marketplace.

202. The Scottish Executive has already made a substantial and welcome investment in ensuring Scotland remains at the forefront of marine renewables development. The Committee commends the Executive's contribution of a £2 million investment in the development of the European Marine Energy Centre (EMEC), at Stromness in Orkney⁷⁹. This centre was established by Highlands and Islands Enterprise in co-operation with the Scottish Executive, the DTI, Orkney Islands Council, Scottish Enterprise, Orkney Enterprise and the Carbon Trust. It is the first centre of its kind and gives Scotland a significant lead in the field of marine technology development.

203. EMEC's main objective is to become a world centre of excellence for the testing, development and certification of marine technology devices. EMEC will play a crucial role in bringing marine devices to market readiness and its location in Scotland should help to give Scottish firms a lead in the development of market-ready marine technology. Previous experience with wind technology has shown that those firms which can deliver reliable cost effective technology to the marketplace early, develop a lead in establishing dominance. This will be vital if the Scottish economy is to achieve the 'critical mass' necessary to corner the marketplace in marine technology.

204. The establishment of a market support system for marine technology will be

crucial to the economic viability of the sector and, consequently, its contribution to meeting Scotland's renewables targets. As previously stated the Renewable Obligation (Scotland) (ROS) places a duty on Scottish electricity generators to produce 18% of their electricity from renewable sources by 2010 and an 'aspirational' 40% by 2020. The current system of market support for electricity generated from renewable sources in the UK system is that of the Renewable Obligation Certificates or ROCs. This is a system of tradable certificates awarded on the basis of each unit of electricity generated from renewable resources. Generators who meet or exceed their renewable generating target can trade in ROCs with those generators who have not met the target. The technologies to which the ROCs system applies are outlined in paragraph 97. Given the current scarcity of renewables in the UK energy market, ROCs currently provide a value of about 6.8p/kWh for electricity generated from onshore wind farms. This price, when compared to the wholesale price for electricity of 2.3p/kWh, provides a significant financial incentive for the development of onshore wind power⁸⁰.

205. As the proportion of electricity generated from renewables approaches the targets set (15.4% by 2015 in the UK), the value of ROCs will decrease to the point where they converge with the wholesale price of electricity. As a result it is likely that the development of onshore wind farms will slow down at this stage. This means that the ROCs will have achieved their objective and developed one source of renewable energy, wind technology, to a stage where it can compete in the marketplace without government support.

206. ROCs are designed to be technology neutral, that is to say not to favour one form of renewable energy generation over another. However, as we have seen from the examination of the onshore wind sector, this is not the case in practice. If the development of the marine sector is to be achieved then it must be able to compete on a financial basis with onshore wind generation. This will require the ROCs system to encourage developers to invest in marine technology and so deliver the critical mass required to allow marine technology to compete effectively.

207. It is clear that the vast majority of renewable generation is being delivered by onshore wind farms. This is because, as a mature developed technology, it is currently the renewable technology which will provide the best market return for the generating companies. Because marine technology is still largely in the development stage, the investment costs and financial risks for generating companies are higher than for onshore wind farms. The end result of this situation is that the development of marine technology is being smothered by the current ROC system.

208. In its evidence to the Committee SEEF stated that in examining the economies which currently dominate the international wind technology manufacturing market, namely Denmark and Germany, a key element in their success was the development of a strong domestic market before developing exports⁸¹. The international market for wind turbine technology is now estimated to be worth £4 billion⁸² per annum.

209. Applying the lessons learned in the development of wind technology over the last two decades, it is even clearer that Scotland's success in capturing the international marine technology market will depend on growing a strong domestic market for marine technology. The Committee believes that this domestic Scottish/UK marine market cannot

be achieved under the current system of ROCs.

210. The current system of ROCs covers the generation of electricity from marine technology. However, given the expected increase in the use of onshore wind generation over the next decade, it is likely that the value of ROCs will decrease too quickly to provide enough of a financial incentive to encourage the market to invest in marine technology to develop it to a level where it can compete with onshore wind farms.

211. One way of addressing this problem would be to vary the current value of the current ROC system so as to provide a higher value per kWh for electricity generated from marine. This could provide a financial stimulus for developers to invest in the development of marine technology and so make it more viable in the UK electricity marketplace.

212. Another method would be to provide a funding mechanism to support the research, development and demonstration phase of marine technology in order to encourage it to develop to market readiness more quickly. This would allow it to enter the market at a stage where the current ROC system would provide enough of a financial benefit for the sector to gain the necessary 'critical mass' in the domestic market and to establish the necessary supply chain, services and infrastructure. This is the approach favoured by organisations such as Wavegen⁸³.

213. Alternatively, a separate dedicated ROC system could be developed specifically to support the development of marine renewables. However, evidence taken from the major power companies suggests that the introduction of another ROC system should be considered in the light of any potential impact on the current system of ROCs. They fear that two or more market support systems for different renewable technologies could increase bureaucratic demands on companies and interrupt the free flow of the market⁸⁴.

214. Irrespective of the advantages or disadvantages of the various financial support mechanisms proposed in the evidence received by the Committee, it is clear there is a real and urgent need to address the outstanding issues in relation to the development of the marine sector, namely how to develop a strong domestic marine renewable sector and how to capitalise on the benefits of the developing international manufacturing market.

215. The Committee recommends that the Scottish Executive undertakes a speedy analysis of the potential market supports systems to establish the system best suited to delivering Scotland's economic and environmental marine renewable goals. This could include varying the current market support systems, such as ROCs, to encourage the development of marine technology. Given the current pace of development in the renewable sector this process must be undertaken immediately. The Executive should not wait for the Department of Trade and Industry review of the Renewable Obligations system due in 2005/06⁸⁵.

Footnotes

¹ A watt is the unit of measurement of power. A megawatt (MW) is one million watts.

² Carbon sequestration is the long-term storage of carbon dioxide in the forests, soils, ocean or

underground in depleted oil and gas reservoirs, coal seams and saline aquifers.

³ The Utilities Act 2000, section 68(8).

⁴ The petitioners from whom the Committee took evidence are listed in paragraph 81

⁵ Department of Trade and Industry White Paper 'Creating A Low Carbon Economy' February 2003

⁶ A watt-hour is an electrical energy unit of measure equal to 1 watt of power supplied to, or taken from, an electrical circuit steadily for 1 hour. A kilowatt hour (kWh) is 1000 watt-hours

⁷ Mr William R Graham, 13 January 2004, Official Report column 363

⁸ Mrs Marilyn Henderson, 13 January 2004, Official Report column 362

⁹ 13 January 2004, Official Report columns 363 and 383

¹⁰ 13 January 2004, Official Report column 390

¹¹ John Thomson, Scottish Natural Heritage, 3 February 2004, Official Report column 543

¹² Bill Band, Scottish Natural Heritage, 3 February 2004, Official Report column 544

¹³ Anne McCall, Scottish Renewables Forum & Royal Society for the Protection of Birds, 3 February 2004, Official Report column 561

¹⁴ Angus Gilmore, Argyll and Bute Council, 20 January 2004, Official Report column 419

¹⁵ Alan Baillie, Ministry of Defence, 23 March 2004, Official Report column 779

¹⁶ www.dti.gov.uk/energy/renewables/publications/index/shtml

¹⁷ Written submission from Mr John Macdonald, page 1

¹⁸ Written submission from Mr John Macdonald, page 1

¹⁹ Written submission from the Scottish Renewables Forum, page 2

²⁰ Written submission from Scottish and Southern Energy, page 4

²¹ Scottish Renewable Forum is Scotland's largest representative body for the renewables industry.

Further information is available at http://www.scottishrenewables.com/about_SRF.asp

²² Written submission from the Scottish Energy Environment Foundation, page 4

²³ Written submission from the Scottish Energy Environment Foundation, page 3, table 1

²⁴ Written submission from the Scottish Energy Environment Foundation, page 3

²⁵ Written submission from the Scottish Energy Environment Foundation, page 1, introduction,

²⁶ Written submission from Scottish Power, page 5, paragraph 4.3

²⁷ Written submission from Scottish Power, page 5, paragraph 4.3

²⁸ Renewable Obligation and Renewable Obligation (Scotland)

²⁹ ROCs: Renewable Obligation Certificates

³⁰ <http://www.offshorewindfarms.co.uk/else.html>

³¹ Written submission from the Scottish Executive, annex a

³² Written submission from Scottish Power, paragraph 4.2

³³ Written submission from the Scottish Energy Environment Foundation, page 4

³⁴ www.scotland.gov.uk/about/ELLD/EN-CS/00017058/page633376673.aspx

³⁵ www.scotland.gov.uk/about/ELLD/EN-CS/00017058/page1525243087.aspx

³⁶ Electricity Act 1989 and the Utilities Act 2000

³⁷ [Key Scottish Environment Statistics 2003: page 1 - www.scotland.gov.uk](http://www.scotland.gov.uk)

³⁸ m/s: Meters per second

³⁹ [BWEA - The British Wind Energy Association - www.bwea.com](http://www.bwea.com)

⁴⁰ Steve Watson, ALIenergy, 20 January 04, Official Report column 421

⁴¹ Steve Watson, ALIenergy, 20 January 2004, Official Report column 422

⁴² Further information on Incoteco AsP is available on their website

<http://www.scottish.parliament.uk/enterprise/reports/www.incoteco.com>

⁴³ Further information on ELTRA is available on their website

<http://www.scottish.parliament.uk/enterprise/reports/www.eltra.dk>

⁴⁴ Dr Brian Smith, Scottish and Southern Energy, 20 January 2004, Official Report column 435

⁴⁵ Alan Mortimer, Scottish Power, 20 January 2004, Official Report column 436

⁴⁶ Written submission from the Scottish Executive, annexe a

⁴⁷ BWEA's UK operation grid connected wind farm list 2004

⁴⁸ BWEA's UK new wind farm's projects list 2004

⁴⁹ Cllr Alison Hay, COSLA, 13 January 2004, Official Report column 395

- ⁵⁰ COSLA, 13 January 2004, Official Report columns 395 and 396
- ⁵¹ NPPG6 - Scottish Executive's National Planning Policy Guidelines (Version 6) published 2000
- ⁵² PAN45 - Scottish Executive's Planning Advice Note 45 (Renewable Energy Technology) revised 2002
- ⁵³ National Planning Framework for Scotland, paragraph 1
- ⁵⁴ National Planning Framework for Scotland, paragraph 94
- ⁵⁵ 20 January 2004, Official Report columns 417, 418, 443 and 444
- ⁵⁶ Section 36 of the 1989 Electricity Act does not include generating stations which are "wholly and mainly" driven by water.
- ⁵⁷ Written submission from Mr Bernard Hamill, page 2 - www.scottish.parliament.uk
- ⁵⁸ George Harper, Argyll and Bute Council, 20 January 2004 Official Report column 416
- ⁵⁹ Written submission from the Scottish Executive, annex a
- ⁶⁰ Written submission from Aberdeenshire Council, page 2
- ⁶¹ Written submission from Royal Town Planning Institute Scotland, paragraph 4
- ⁶² National Planning Framework for Scotland, paragraph 138
- ⁶³ Written submission from Royal Town Planning Institute Scotland, paragraph 5
- ⁶⁴ COSLA, 13 January 2004, Official Report column 397
- ⁶⁵ David Sigsworth, Scottish and Southern Energy, 20 January 2004 Official Report column 442 to 443
- ⁶⁶ Susan Reilly, Scottish Power, 20 January 2004, Official Report column 443
- ⁶⁷ 30 March 2004 Official Report column 451
- ⁶⁸ Written submission from Highland Council, page 8, paragraph 9
- ⁶⁹ Alan Mortimer, Scottish Power 20 January 2004, Official Report column 435
- ⁷⁰ Deputy Minister for Enterprise and Lifelong Learning, 30 March 2004, Official Report column 818
- ⁷¹ Deputy Minister for Enterprise and Lifelong Learning, 30 March 2004 Official Report column 833
- ⁷² Danish Energy Authority's 2002 Energy Sector Exports Report: <http://www.ens.dk/sw1212.asp>
- ⁷³ National Planning Framework for Scotland, paragraph 173
- ⁷⁴ Dr Gary Connor, Scottish Energy Environment Foundation, Official Report column 798
- ⁷⁵ A watt-hour is an electrical energy unit of measure equal to 1 watt of power supplied to, or taken from, an electrical circuit steadily for 1 hour. A megawatt-hour (MWh) is one million watt-hours.
- ⁷⁶ Deputy Minister for Enterprise and Lifelong Learning, 30 March 04, Official Report column 839
- ⁷⁷ Written submission from Wavegen Ltd, page 1, paragraph 2
- ⁷⁸ Written submission from Institute for Energy System, page 4
- ⁷⁹ Deputy Minister for Enterprise and Lifelong Learning, 30 March 04, Official Report column 821
- ⁸⁰ Written submission from the Scottish Energy Environment Foundation, appendix b
- ⁸¹ Written submission from the Scottish Energy Environment Foundation, page 4
- ⁸² Written submission from the Scottish Energy Environment Foundation, page 4
- ⁸³ Written submission from Wavegen ltd , page 3
- ⁸⁴ Scottish Power, Official Report column 432 to 433
- ⁸⁵ Deputy Minister for Enterprise and Lifelong Learning, 30 March 04, Official Report column 827

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BIOMASS AND BIO-FUELS

216. While the main renewables debate in Scotland to date has mainly focussed on issues such as the development of onshore wind farms and the potential of marine renewables, there are many other types of renewable energy sources available in Scotland. One which is widely used on mainland Europe is biomass.

217. Biomass⁸⁶ is the process of using organic matter, such as straw or wood pellets, or other organic materials, to generate electricity via combustion. This can either be done by burning the matter on its own or in combination with other traditional fossil fuels such as coal or gas. This latter process is known as 'co-firing'. Biomass co-firing is widely used in countries such as Denmark and Germany to provide heating and hot water to urban and rural communities on a large scale. During the Committee's case study trip to Denmark, members visited the Avedøre co-firing power station outside Copenhagen, a plant operating two power generators, one of which uses co-firing of waste straw from the Danish agricultural sector and wood pellets made from waste wood from the furniture manufacturing sector. This is co-fired with natural gas to provide heating and power to up to 1.2 million homes in eastern Denmark. The Committee heard from The Scottish Coal Co Ltd that it has successfully trialled a 'combi' fuel, made from wood residues and coal, and that this fuel has the potential to be used to attract ROCs support⁸⁷.

218. The development and use of carbon sequestration technology⁸⁸ further reduces the level of emissions. During the Committee's case study visit to Denmark, members heard how the use of co-firing in Combined Heat and Power (CHP)⁸⁹ systems allows the Danes to achieve a fuel efficiency level of up to 80%. That is to say that up to 80% of the potential energy from a fuel source is extracted and used in the generating process. In contrast, the UK extracts only about 25% to 30% of the potential energy from the combustion of traditional fossil fuels such as coal⁹⁰. CO₂ captured during the generating process can also be used to assist offshore oil extraction. The gas is pumped underground where, in addition to increasing the amount of oil that can be extracted from North Sea wells, it can then be stored.

219. While the development of CHP biomass plants on a large scale in Scotland would involve the high capital costs of installing large scale district heating systems, there is great potential for using biomass/CHP in local community developments, especially in rural Scotland. The Scottish Coal Company Ltd cites a DTI study which suggests that 1,800 jobs could be created⁹¹.

220. During the evidence taking session held in Campbeltown on 20 January 2004, the Committee heard from Argyll and Bute Council and their energy management agency, Argyll, Lomond and the Islands Energy (ALIenergy). Both the Council and ALIenergy highlighted to the Committee the potential economic and environmental benefit of the use of biomass. Argyll and Bute Council stated that in their council area alone they had potentially huge biomass reserves as it contained 10% of the entire UK's coniferous forest⁹².

221. This resource provided Argyll and Bute with the environmental potential to generate heat and power for local communities through the development of small scale CHP. Use of biomass also provides economic potential for rural economies, such as Argyll and Bute, to benefit from the generation of electricity. The use of local biomass resources for local generation also has the added benefit of reducing the need for transportation of fuels over long distances and so saves on emissions. In its written submission to the Committee, Argyll and Bute Council called for the extension of the ROC system to include heat generation from biomass sources. According to George Harper of Argyll and Bute Council this would: "create opportunities for those using woodchip boilers to benefit from the trading of ROCs, thereby generating an income"⁹³.

222. The potential to utilise Scotland's biomass resource in achieving its renewable energy targets should not be overlooked. To achieve this, ALIenergy has called for the current market support system of ROCs to be extended from electricity generation to include heat generation from renewable sources. In order to achieve a basis to deliver biomass heating, ALIenergy is of the view that it is vital to develop and expand local supply chains to underpin the success of a future biomass sector. This expansion could be achieved by way of grant support delivered through the Local Enterprise Networks⁹⁴.

223. The utilisation of Scotland's forest resources for energy production through biomass, by way of a market support system such as ROCs, would require careful management. It would be essential to ensure a "like for like" basis in the felling and planting of trees. This would be necessary to maintain carbon neutrality and maintain a sustainable forestry sector⁹⁵. Biomass could provide a real solution to the problems of under-maintained forestry in Scotland, by making forest maintenance economically viable. In turn this could produce long-term, sustainable employment in rural areas.

224. The potential role of biomass in helping to meet Scotland's 40% 'aspirational' target by 2020 is one which is supported by SEEF. In evidence to the Committee Dr Gary Connor referred to the success of countries such as Finland in utilising biomass as part of their energy generation system⁹⁶.

225. The Committee recommends that the Scottish Executive examines the potential to support and develop the biomass sector in Scotland by identifying the most suitable financial support method for biomass in the market. As with support for the development of marine technology, this process must be undertaken immediately.

226. The Committee also received evidence on the potential for bioenergy heating systems to be used in Public/Private Partnership (PPP) projects. Buccleugh Biofuels pointed out that, because PPP contracts cannot specify particular heating technologies, contractors tend to use low installation cost systems, ie electricity, which then produce high running costs for the end-user. Buccleugh Biofuels stated that: 'In earlier discussions with the Executive a possible way round this has been identified. The Local Government Act could be amended to put 'Best Value' on a par with the 'Sustainability Agenda', thus allowing a proposal from a contractor who had not placed any

emphasis on environmental concerns to be rejected, potentially despite 'Best Value'. A review of how renewable heating systems can be incorporated into new build PPP projects could be initiated⁹⁷.

227. The Executive should consider ways of incorporating sustainability into Best Value rules, to encourage biomass and sustainable energy in public procurement for new public build, especially in relation to Public Private Partnerships.

228. The Committee has also received evidence on several projects in Scotland which look at the potential development and use of bio-fuels. In its submission to the inquiry, the Westray Development Trust outlined how the development of technologies such as bio-fuels could have a significant benefit for rural communities which have to cope with very high fuel costs for transportation⁹⁸.

229. During the Committee's case study visit to Orkney on 7 May 2004, members met with representatives of the Orkney Renewable Energy Forum and the Westray Development Trust. Members were impressed with the determination and enthusiasm with which a peripheral community such as Orkney was becoming a leader in the field of renewable energy development. The renewable sector in Orkney is actively developing projects such as the use of bio-ethanol and bio-diesel for transport fuel. Members heard about the Trust's plans to develop cooking oil as a bio-fuel for transport and increase the benefit economically by retaining control of the supply chain. This would work by 'leasing' oil to users such as hotels who would use it for cooking. The oil would then be returned to the Trust, for use as bio-fuel for transport. This has economic potential for rural communities as it provides a clean, environmentally friendly transport fuel source, which is under the control of the community. It has the added advantage in that the cooking process enriches the quality of the oil as a fuel. The Trust would be able to benefit economically from leasing the oil as well as gaining an enriched fuel source.

230. The Committee notes the work of groups such as the Orkney Renewable Energy Forum and the Westray Development Trust as excellent examples of how the broader renewables sector can benefit the lives of communities throughout Scotland, both economically and environmentally.

231. During its presentation, the Trust highlighted the difficulty of obtaining licences to operate stills for the processing of ethanol for bio-diesel as being one impediment to the continuing development of small/medium scale bio-fuels projects in areas such as Orkney.

232. The Committee recommends that the Executive examine ways of simplifying the granting of licences to operate stills for the processing and development of small/medium scale bio-fuels projects.

233. Members of the Committee also visited Orkney College and received a presentation on the development of several bio-fuel projects such as their willow growing biomass project to provide energy through the use of willow wood in small scale CHP.

234. Orkney College was keen to point out the need for a broader definition of the biomass/bio-fuels sector to include more than simply its use in electricity and heat generation through CHP and as an alternative fuel for transport. Members were impressed with the work Orkney College's Agronomy Institute is undertaking in conjunction with the Non-Food Plant Research Centre in York on the development of plants for bio-dyes for industrial use and plants developed for use in

areas such as the pharmaceutical and furniture industry⁹⁹.

OTHER RENEWABLE TECHNOLOGIES

235. The Committee has also received evidence on other types of renewable technologies which, if developed to their full potential, will assist in achieving Scotland's environmental and economic objectives.

Micro and Small-scale wind developments.

236. This report has dealt with large-scale wind developments above at paragraphs 92 to 131. However the Committee has heard that there is real potential for micro and small-scale wind developments. The Committee was particularly impressed by presentations on small turbines for domestic use and use by small and medium-sized enterprises¹⁰⁰. Any grid connection issues for small-scale wind must be resolved speedily by Ofgem and the grid owners to enable this area access to the market in order to develop its potential.

Hydro-electricity

237. Despite the development of the large scale hydro-electric projects in the Highlands in the post-war era, the Committee has received evidence that there is still potential for the development of small scale hydro-electric projects in Scotland. It is estimated that this could provide about 11MW of installed capacity by 2020¹⁰¹.

238. In evidence to the Committee, Maf Smith of the Scottish Renewables Forum (SRF) stated that the potential for community development of small scale hydro-electric schemes should not be overlooked. However development in this area could be hampered by current legislation¹⁰².

239. Just as with onshore wind farms in excess of 50MW, proposed hydro-electric schemes in excess of 1MW are subject to section 36 of the Electricity Act 1989. This means that, while the local authority in question would conduct the planning process, including any necessary consultations and studies, the decision to grant or refuse permission rests with the Scottish Ministers. The planning fee for such a hydro-electric development would also go to the Scottish Ministers. SRF supports calls for local authorities to be properly resourced to allow them to deal with hydro-electric projects of this nature¹⁰³.

Photovoltaic and Fuel Cell Technology

240. The potential benefits from the development of photovoltaic and fuel cell technology for areas such as the transport sector are considerable. Evidence received by the inquiry suggests that advances in these technologies is making their practical use in everyday society more feasible.

241. In evidence to the inquiry, Scottish Enterprise highlighted the fact that Scotland has developed a unique cluster of companies and academics that are collaborating to develop fuel cell technology¹⁰⁴.

242. Members of the Committee had an opportunity during the inquiry to visited some of the companies at the leading edge of the development of this technology. On 10 May 2004 members visited SiGEN UK Ltd and Robert Gordon University in Aberdeen to see the work being carried out in the field of fuel cell development. Members were impressed by the work under way, such as

the development of a fuel cell powered electric wheelchair. The Committee also saw the work SiGEN is undertaking in partnership with the Unst Partnership¹⁰⁵ on the development of hydrogen cell technology for transport.

243. SiGEN were anxious to emphasise that Scotland must not lose out on the potential hydrogen economy to competitor countries such as Canada and Germany, where gaining the upper hand in the development of the hydrogen economy is high up the political agenda. SiGEN believes that the Scottish Executive must develop a dedicated Hydrogen Strategy for Scotland, so as not to lose out on the advantage Scotland currently holds. SiGEN pointed out that areas such as Wales, California and Germany already had hydrogen strategies in place.

244. The inquiry also received evidence on the growing uses of photovoltaic technology. In evidence to the inquiry, Highland and Islands Enterprise stated that photovoltaic technology was being used to power streetlights and public toilets in the Highlands area. A number of electrical installers and plumbers in the Highlands were considering using photovoltaic technology¹⁰⁶.

245. There is often a common misconception amongst the public that Scotland is not suitable for 'solar power' technology. This was refuted by the Deputy Minister for Enterprise and Lifelong Learning in his evidence to the Committee when he stated "contrary to some preconceptions, solar energy can be effective in Scotland, because we have a lot of daylight hours, at least at certain times of the year"¹⁰⁷.

246. The Committee welcomes the Executive's commitment to continued funding for photovoltaic and fuel cell research¹⁰⁸. However, the Committee is of the opinion that Scotland cannot afford to lose out on the economic potential offered by the development of these technologies.

247. The Committee recommends the Executive establishes a hydrogen development strategy as part of the overall development of a Scottish Energy Policy. This should seek to cover the development and proof of concept chain of the hydrogen sector and address any gaps which may currently exist in the funding and development process in Scotland.

Solar Heating

248. The Committee heard from the Scottish Renewables Forum that passive solar heating has the potential to contribute significantly towards the Executive's targets¹⁰⁹. A typical domestic system will provide half the annual domestic hot water for an average house in Scotland, and can save 2000kg of CO₂ per annum.

249. The Committee notes that grants are available for installation of solar heating under the Scottish Community Housing Renewable Initiative, supports the continuation of this grant scheme, and notes that an expanded programme of solar panels installation could address fuel poverty, create up to 400 jobs and create export opportunities.

Geothermal

250. Geothermal energy is heat (thermal) derived from the earth (geo). It is the thermal energy contained in the rock and fluid that fills the fractures within the rock of the earth's crust. The Committee heard from Highlands and Islands Enterprise that its Community Energy Unit was supporting a small number of geothermal projects, but that there was no evidence on the potential for wider use of geothermal. The Committee considers that the Executive should commission a

study to ascertain the most productive areas for geothermal power, so that the Enterprise Agencies may promote it where possible.

Land fill/Methane Extraction

251. Given Scotland's long coalmining history and the level of landfill disposal used for domestic and commercial waste, there may be considerable potential to utilise the production of methane gas from these areas. Methane is naturally produced from the biological decomposition of organic matter. It also occurs naturally in the soil and so mine workings and landfill sites can emit considerable quantities of methane.

252. As methane is highly combustible, it is well suited to the generation of electricity. Methane capture from mines and landfill sites also has the added advantage of preventing the gas from escaping into the atmosphere and adding to climate change since, although quantities of methane in the atmosphere are much lower than carbon dioxide, as a gas which contributes to climate change it is about 23 times more harmful than carbon dioxide¹¹⁰.

The Electricity Market and the Grid

253. Throughout the course of the inquiry the issue of the Scottish Grid (transmission and distribution) and the structure of the UK electricity market has been raised repeatedly in relation to the development of the renewables sector in Scotland and its ability to contribute to renewables targets. More than any other issue during this inquiry, the current state of the transmission grid network in Scotland and the plans to upgrade and strengthen it seem to be the most pressing concern of those looking to develop and grow the renewable sector for the economic and environmental benefit of Scotland.

254. This report has already looked at the issue of intermittency on the grid in relation to wind power as an intermittent source of supply. Much of the concern in relation to intermittency stems from two wider issues in relation to the transmission grid: the strength of the grid to meet current and future electricity demand; and the impact of renewable energy on the grid.

255. The transmission grid in Scotland, like the rest of the UK, was originally designed to transmit electricity outwards from the generating stations at the centre of the network to commercial and domestic users at the periphery. In rural Scotland this required a grid network extending outwards to areas such as the Orkneys, Shetlands and Western Isles so as to transmit electricity to those areas most geographically distant from the generating stations.

256. However, it is in the very areas where the grid is at its weakest that the highest potential for renewable energy generation is to be found. The transmission grid of the 21st Century will be required to reverse its transmission role so that energy generated from renewable sources in the geographically remote parts of the country can be transmitted to consumers in densely populated urban areas.

257. In Scotland, the grid is owned and operated by the two main electricity generating companies, Scottish Power and Scottish and Southern Energy. Currently, the electricity market and transmission system in Scotland operates separately from that in England in Wales. However, 2005 will see a Great Britain wide electricity market, with the introduction of the British Electricity Transmission and Trading Arrangements (BETTA). The purpose of BETTA in creating a single GB-wide electricity market is to benefit electricity customers by delivering lower prices through

increased competition in a larger market.

258. A major issue for the development of the renewable sector is the need to strengthen the transmission grid network in Scotland to meet the demands which will be placed upon it in the future. The grid connection is a precondition for the exploitation of the electricity marketplace.

259. The current operators of the grid in Scotland both stated in evidence that upgrading and strengthening the capacity for the grid in Scotland was a major priority¹¹¹. As part of its response to this priority, Scottish and Southern Energy has announced a major capital investment in the grid network with plans to upgrade 140 miles of the transmission network between Beaully (near Inverness) and Denny (near Falkirk), from a 132kV¹¹² to a 400kV power line¹¹³. This, according to the Scottish and Southern Energy, will cost about £200 million and could be operational by late 2007¹¹⁴. This will be a key link in the development of the transmission grid in northern Scotland and is essential if the full renewable potential of the country is to be exploited.

260. A key factor in the delivery of this upgrade is the time it will take for the planning and construction process to be completed. Currently, Scottish and Southern Energy plans to have the new Beaully to Denny line completed by late 2007. However, during the Committee's case study visit to Orkney, members heard doubts expressed over the achievability of this timescale. Representatives from Highland Council raised the concern that the size of the project may require a public inquiry to be conducted, which could add to delays in the completion of the project. It was claimed that the upgrade of this line may be delayed until as late as 2010. These concerns are reflected in the written evidence received by the inquiry from Highland Council. The submission points out that proposed sections of the construction of the upgrade may impact on sensitive areas and that Scottish and Southern Energy may have to consider "the undergrounding of electricity lines in sensitive areas to avoid unsightly visual and landscape impact"¹¹⁵. It also seems likely that the construction of this project, with the associated pylons and substations required to cross large areas of the Highlands, will be likely to attract the same kind of public objections in relation to visual impact and effects on tourism as those for onshore wind farms.

261. Any delay to this upgrade of this line will have a resultant impact on the development of renewable projects throughout the wider Highlands and Islands area. It will also cause delay to the extension of a strengthened grid network across the wider Highlands and the Western and Northern Isles. It is essential that the necessary grid reinforcements be made in time to allow the economic potential from the expanding Scottish renewables sector to be realised.

262. The Committee noted from the evidence received from the Department of Trade and Industry that a Transmission Issues Working Group (TIWG) has been established between the Department, Ofgem¹¹⁶ and the transmission companies. The Scottish Executive is also a member of TIWG¹¹⁷.

263. The Committee therefore recommends that the Scottish Executive take a lead on the issue and ensure that local and national interests are considered in planning decisions on grid upgrades. The Executive should co-ordinate with Scottish and Southern Energy and the various local authorities involved to overcome any obstacles which may cause a delay to the completion of the Beaully to Denny grid project.

264. Of equal importance to the future of Scotland's renewable sector is the strength of the grid connections between Scotland and the rest of the UK and, consequently, onwards to elsewhere in Europe. The Committee noted in the evidence received from National Grid Transco on 16 March that the current connection capacity allows 2200MW of electricity to be sent from Scotland to

England¹¹⁸. Areas of high electricity demand in England and Wales will provide a significant proportion of the market for the newly developing renewables sector in Scotland. Therefore the upgrading and strengthening of these connections will be vital in securing the growth of the renewable sector in Scotland.

265. The Committee also noted the point made by National Grid Transco regarding Ofgem's regulations on transmission companies recouping capital expenditure on reinforcement to the transmission network if, in the opinion of Ofgem, such investments were efficiently incurred. Dr Lewis Dale from National Grid Transco stated that the inability of the current trading arrangements in England and Wales to demonstrate that the growing Scottish renewables sector will require reinforcement to the transmission system could stifle the short to medium term growth of the Scottish renewables sector¹¹⁹. The introduction of BETTA will, in time, demonstrate the need for investment in the transmission network, but in the meantime the restrictions on the system grow as the renewables sector expands.

266. National Grid Transco, Scottish Power and Scottish and Southern Energy are seeking approval from Ofgem to commence capital investment as soon as possible. If Ofgem agrees to this request, this capital investment would be recouped by the transmission companies by way of higher charges to their customers. Ofgem consulted on these proposals in October 2003 and National Grid Transco believes Ofgem will deal with this issue as part of the regulatory arrangements for dealing with the extension of transmissions companies system of price controls. This is expected in summer 2004.

267. Strengthening the grid connection system between Scotland and the rest of the United Kingdom will also be an important factor in ensuring the stability of the grid and countering the impact of intermittency from certain renewable sources such as onshore wind.

268. Physical strengthening of the grid is not the only issue involved. Greater reliance on renewable energy will require more flexible grid management systems. A recent article in the Economist¹²⁰ sets out some of the technological advances currently being made to address grid instability. Scotland's particular grid upgrading needs could well be met in the longer-term by cutting-edge technology, as well as, or perhaps instead of, large-scale capacity increases. There may be a need to re-imagine the grid, as well as reinforcing it, to accommodate the rapidly-changing needs of generators and consumers in the future.

269. The Committee believes that the upgrading and strengthening of the transmission system, both within Scotland and between the rest of Great Britain, is of paramount importance to the development of a strong Scottish renewable energy sector. The Committee would urge Ofgem to look favourably on any proposals to speed up the capital investment required to reinforce the transmission grid.

Energy Conservation and the UK White Paper

270. In February 2003 the Department of Trade and Industry published an energy White Paper entitled "Our Energy Future - Creating a Low Carbon Economy". The overall aim of this White Paper is to develop the UK's economic and energy policy so as to reduce the production of carbon dioxide, the atmospheric gas most responsible for climate change¹²¹. The paper sets out four goals for the UK's energy policy, as follows:

- put the UK on the path to a 60% reduction in carbon emissions by 2050, with real progress to

be achieved by 2020;

- maintain the reliability of the UK's energy supplies;
- promote competitive markets in the UK and beyond, raising the rate of sustainable economic growth and improve productivity; and
- ensure every home is adequately and affordably heated.

271. Under the Kyoto Protocol on Climate Change, the UK committed itself to reduce its greenhouse gas emissions by up to 12.5% below 1990 levels by the first commitment period (2008-2012). UK emissions in 1990 were 208 million tonnes (carbon equivalent) of greenhouse gases of which 165 million tonnes was CO₂ (carbon dioxide). By 2001 UK emissions had reduced to approximately 182 million tonnes (carbon equivalent) of greenhouse gases of which 156 million tonnes was CO₂¹²². In order to achieve the 2050 target set out in the White Paper, this level will need to be reduced to approximately 63 million tonnes of CO₂. To achieve this, the White Paper aims to achieve a 40% reduction in carbon emissions by 2020. Key to achieving this target will be a reduction in the amount of energy consumed by society coupled with a substantial increase in the use of renewable energy¹²³.

272. In the area of energy efficiency the White Paper sets out the necessary levels of carbon reduction required from each sector of society in order to meet the 2020 target¹²⁴. Up to 40% of this reduction will need to come from energy efficiency in the domestic household and transport sectors.

273. In Scotland, the Executive has set targets for the generation of electricity from renewable sources. However, it has been noted during the inquiry that electricity generation only accounts for about 20% of all the energy consumed by society¹²⁵. Sectors such as space and water heating and public/private transportation account for about 60% of energy consumed. Therefore, any policy designed to address Scotland's carbon emissions must include targets for these sectors as well as for electricity generation.

274. The Executive's renewable energy strategy was set out in 2003 with the publication of "Securing a Renewable Future - Scotland's Renewable Energy". In this the Executive stated that "energy efficiency has a crucial role to play if we are to achieve significant cuts in carbon emissions"¹²⁶.

275. This fact was underlined by the Deputy Minister for Enterprise and Lifelong Learning, Lewis Macdonald, in his evidence to the Committee on 30 March. The Minister stated that "we cannot estimate with absolute confidence what [energy demand] will be by 2020, but we can say that, in the interim period, we will be pursuing policies of increased production from renewables and greater energy efficiency"¹²⁷.

276. The Executive has established a Climate Change Unit, which works to promote climate change measures throughout the work of Scottish Ministers. The Scottish Climate Change Programme was published in November 2000. It sets out the activities being undertaken across the Executive to reduce carbon emissions. This document is due to be reviewed in 2004-05.

277. A key activity is the Scottish Community and Householder Renewable Initiative (SCHRI). The first main objective of the SCHRI is to act as a 'one stop shop' advisory service for community

groups and householders interested in developing renewable energy solutions.¹²⁸ Secondly, the Executive has provided £5 million in funding to the SCHRI to fund a grant scheme for community groups and householders wishing to develop their own renewable energy solutions. Capital funding is available up to a level of 30% of the cost of a project, capped at £4000 for individual households or £100,000 for community based projects. This three year scheme is due to finish in spring 2005.

278. The Committee noted the Minister's remarks on the success of the SCRHI to date¹²⁹ and welcomes the commitment to build on the success of the scheme, both in terms of the public interest it has generated and the way in which grant funding has been delivered, as a basis for the future.

279. The Committee also welcomed the announcement as part of the 2005-06 budget process that Ministers intend to launch a Public Sector Energy Efficiency Initiative, with £10 million per annum funding in 2005-06 and 2006-07. Savings achieved through this initiative will be partly reinvested into the fund and partly used for service delivery¹³⁰.

280. From the evidence taken it is clear that, if UK targets are to be met, energy efficiency and conservation must become top priorities. This point was summed up in the evidence of Steve Watson of ALIenergy when he stated that "every kilowatt hour that we save means 1kWh that does not need to be generated"¹³¹. Members noted with interest the suggestions of ALIenergy in relation to ways of increasing levels of energy efficiency in housing, for example the need to examine the eligibility criteria for pensioners under the Warm Deal scheme (which provides grants for energy efficiency measures for people on low incomes), as well as the measures for improving energy efficiency under the Executive's central grant heating programme¹³².

281. The Committee recognises that the Executive is making a continued and increasing commitment to energy efficiency measures and supports the approach whereby such measures are mainstreamed across all Executive activity. At present, however, progress is not easy to measure, as targets for various activities are either scattered or do not exist.

282. The review of the Climate Change Programme may offer the opportunity to collate energy efficiency information to give a clearer picture of activities, expenditure, targets and progress. **The opportunity should also be taken to set and publicise clear measurable targets for the reduction of energy consumption in the Scottish domestic heating and transport sectors.**

283. The Committee congratulates Argyll and Bute Council and its energy management agency ALIenergy on the model developed for delivering environmental, economic and social needs through energy efficiency. The Committee believes that the approach taken by ALIenergy in, for example, matching the opportunities provided through the Warm Deal with the skills training provided under the New Deal, is a model for a system by which national targets on energy efficiency could be achieved.

284. **The Committee recommends that the Scottish Executive examines the potential for disseminating good practice in linking the Warm Deal and the New Deal.**

Securing economic benefits for Scotland

285. Throughout the course of the inquiry, the Committee has taken evidence on the economic potential which the renewables sector holds for Scotland. It is clear from the body of evidence received during this inquiry that the development of a thriving Scottish renewable sector holds

enormous potential for all areas of the Scottish economy.

286. Many of the submissions received by the inquiry have outlined the need for local communities and Scotland as a whole to benefit from renewables. A point raised again and again by witnesses was the fact that many groups in local communities were opposed to the wide scale development of onshore wind farms in their area because there was no obvious benefit for the local community. This has led to the argument that major onshore wind farm developments only benefit the major power companies who develop them.

287. On 16 March 2004, the Committee took evidence from the Baywind Energy Co-Operative (Baywind). This co-operative, the first and largest in the UK, was established in Cumbria in 1996 to offer community ownership in Cumbria-based renewables projects. In 2002 Baywind established a management arm called 'Energy4All'. The aim of Energy4All is to "enable local communities to invest in and develop their own renewable energy developments or partake in larger developments in their region"¹³³.

288. In her evidence to the Committee, Angela Duignan of Baywind explained how, through the work of Energy4All, agreement has been reached with the developers of a wind farm project at Boyndie in Aberdeenshire to sell shares to the local community. This would allow local people to establish their own energy co-operative to address environmental measures¹³⁴. Energy4All acts as a facilitator by using their knowledge and experience to help local communities benefit from renewable projects. The potential for local community development through the shared ownership of renewable energy project is significant. For example, Highlands and Islands Enterprise has estimated that a conservative income from one medium size wind turbine (1MW) is about £100,000. This is after operational and maintenance costs but before tax¹³⁵.

289. The Committee believes the co-operative model demonstrated by Baywind is an excellent example of how to ensure community ownership and benefit in all forms of renewable projects. Establishing a 'bottom-up' model of development for growing the renewable energy economy will provide a strong base for its future success. If this model is to succeed, however, it will require the active support of the Executive¹³⁶.

290. The Scottish Executive should continue to raise the visibility of promoting the concept of community ownership of renewable projects. A key factor in delivering public support for a Scottish renewable economy will be in demonstrating to the public that they have an active role to play in its development. Key to this will be the need to provide assistance to local communities to overcome immediate problems such as the financing and knowledge development of community renewable projects. While the development of small scale community owned projects will not in themselves solve the larger national issues regarding renewable energy, they will be important in developing a strong renewable community culture in Scotland. This will be invaluable in establishing other renewable technologies, particularly biomass, as part of Scotland's renewable mix.

291. This can help lay the foundations to the wider development of the renewable economy in Scotland. From the evidence received by the inquiry it is clear that, in order to generate as much renewables based prosperity as possible in Scotland, time is of the essence.

292. To date, estimates on the number of full time jobs which could be created in Scotland by 2020 from the development of renewables vary greatly. The Scottish Energy Environment Foundation estimated that there could be 9000 full time equivalent renewable jobs in the Scottish economy by

2020¹³⁷. The Scottish Renewable Forum estimates that by 2020 the renewable sector in Scotland could employ 20,000 people and be worth £1 billion a year to the Scottish economy¹³⁸.

293. In January 2004, a study co-sponsored by the Scottish Executive ¹³⁹, estimated that, at present, 1900 people are employed by the renewable sector in Scotland and that by 2020 anywhere between 17,000 and 35,000 jobs will be created in the UK through the direct growth of the renewables sector. While the study was not able to estimate how many of these jobs would be in Scotland, the Executive stated in its submission that it expected "many of these [jobs] will be in Scotland".

294. Regardless of the wide variation in the estimates of jobs which may be created by the renewable sector, it is clear that there is enormous economic potential for Scotland in realising its renewables potential.

295. An important conclusion of this study is the fact that, on average, 10 full time jobs are sustained per megawatt installed. Based on this, the renewable energy sector has the potential to become one of the most important growth area for the Scottish economy for the next quarter of a century.

296. Scotland is in a unique position to be able to create significant numbers of green jobs through encouraging and investing in leading edge renewables technologies. Scotland has natural resources unrivalled in Europe for the generation of energy from marine sources. This is new technology with several countries vying for control of the market.

297. Scotland cannot afford to lose out, either to other competitor countries, or other regions of the UK, in the battle for the renewable economy. Whoever wins will enjoy major economic benefits as the technology spreads around the world. The Committee believes that the opportunities and potential benefits presented by the renewable energy sector are so great that the Executive should be prepared to invest significantly in the sector. It should be treated as a priority sector by the enterprise networks and the full range of business support mechanisms should be brought to bear on its development.

Planning for the 2020 Energy Mix

298. The Scottish Executive has set the 'aspirational' target of 40% of Scotland's electricity generation from renewable resources by 2020. As we have seen from the evidence so far, Scotland currently generates about 11% of its electricity from renewables and, with the growth in onshore wind, will achieve its 2010 target of 18% renewable electricity.

299. Should Scotland achieve its 2020 target it will still require to generate 60% of its electricity needs from conventional sources and if it falls short of the 40% renewable target, it will still require to generate even more in this way. The vital question to answer is: how will that demand be met?

300. Scotland is currently a net exporter of electricity. Each year Scotland consumes about 34TWh¹⁴⁰ of electricity. This compares to the 48.9TWh which is generated each year in Scotland¹⁴¹. The bulk of this surplus is exported to England and Wales. However, the introduction of renewable energy generation sources and the retiring of conventional generating plants which have reached the end of their working life (coal, nuclear, etc) will mean the 'mix' of generating capacity in Scotland may change substantially over the next two decades.

301. The wider energy mix throughout the UK is also set to change. The Department of Trade and

Industry estimates that by 2005/06 the UK will become a net importer of gas and, by 2010, a net importer of oil¹⁴². This means that both the UK and Scotland will have to look to new sources of supply to generate electricity. The proportion of fossil fuels the UK imports will increase over the next decade, while new sources of domestic generating capacity, such as renewables, will become more and more important.

302. During evidence from British Nuclear Fuels and British Energy it was suggested that Scotland could face a shortfall in its electricity generating capacity by 2020. This is based on assumptions that current generating capacity will decrease as a result of the decommissioning of coal and nuclear power plants which will have reached the end of their working lives by 2020, coupled with a continued increased in the demand for electricity. British Energy suggests that this gap could be as much as 20Twh¹⁴³.

303. The nuclear industry argues that the only way to prevent this situation arising, while achieving the UK's carbon reduction emission targets, is by building new nuclear plants. As the likely timeframe for new nuclear plant to come online (from design to operation) is about 10 years, British Energy suggests that the working life of nuclear plants currently operating in Scotland should be extended¹⁴⁴. Scotland currently has three nuclear power plants in operation. Chapelcross in Dumfriesshire is scheduled to close in 2005. Hunterston in Ayrshire is due to be decommissioned by 2011 and Torness in East Lothian is due to close about 2023.

304. In his evidence to the inquiry, Dr Chris Anastasi of British Energy suggested that an extension to the operational lifespan of the Hunterston nuclear power station up to 2016, would be beneficial to the Scottish economy. This, in Dr Anastasi's opinion, would allow other renewable sources to come on stream¹⁴⁵.

305. As the proportion of fuel imports increases, the UK's energy supply chain will become more susceptible to geopolitical issues beyond its control such as international security and terrorism, war, oil prices and potential political instability in fuel exporting countries. In future it is likely that much of the UK's gas and oil imports will come from areas where these issues are likely to be a major factor affecting supply (e.g. Russia and the Caspian Sea basin).

306. Given the structure of the electricity market in the UK the most important questions which need to be answered in relation to future energy supply are, 'can the market deliver the level of generation capacity which will be required by 2020' and 'how stable will that supply be'? From the evidence taken so far the Committee feels it is not in a position to formulate an answer to these questions at this time. The issue of a potential energy gap in the future will depend, in large part, on the level of demand in 2020. The DTI, in its 2003 White Paper, stated that while it is possible to estimate the UK's electricity demand with reasonable certainty up to 2010, demand levels after that date become much harder to predict¹⁴⁶. However, increasing demand for electricity can be countered by improved energy efficiency, for example by expanding and strengthening the Climate Change Programme, and/or by further demand reduction measures.

307. However, all the experience tells us that the demand for electricity has risen inexorably. It is essential for the future of electricity supply in Scotland that major work is undertaken by the Scottish Executive in the short term to estimate the levels of generating capacity the market will be likely to deliver by 2020 and, based on the estimated demand, what action may need to be taken to address any predicted shortfalls in supply.

308. It is clear from the evidence taken during the inquiry that the Renewables Obligation

(Scotland) scheme has been successful, but in a single direction - that of promoting onshore wind. It has led to the invigoration of the market for wind power by energy companies, but without developing other sectors. Whilst this may be welcome in terms of meeting targets, it has raised concerns over the merits of wind power and has not stimulated other renewables generating technologies to a significant degree. By focussing power companies' attention on wind, it may even have hindered the commercialisation of other renewable technologies.

309. The Committee recommends that the Scottish Executive undertakes research, as soon as possible, to estimate the generating capacity the market will be capable of delivering by 2020 and develops its energy policy to address any potential shortfall in supply.

A Strategic Energy Policy for Scotland

310. Throughout the course of this inquiry there has been debate amongst witnesses as to the merits of the Scottish Executive developing a dedicated renewable energy policy for Scotland.

311. The sudden growth in applications of onshore wind farms in Scotland, as a result of the ROS,¹⁴⁷ has led many to question the ability of the Scottish planning system to cope with the development of renewables and raised questions as to whether there is sufficient democratic accountability in the system.

312. The growing debate in the media, fuelled by very vocal opposition to onshore wind farms, has led some to question whether onshore wind development may be more detrimental than beneficial to the growth of the renewable sector in Scotland in the long term.

313. In its evidence to the inquiry, COSLA called for the Executive to establish a clear policy which would outline how different local authority areas of Scotland should aim to deliver on the renewable targets for 2010 and 2020. This was a view supported by representatives from Highland Council who met with members of the Committee during their case study visit to Orkney on 6 May 2004. Highland Council pointed out that a recent consultation document from the Office of the Deputy Prime Minister on planning guidance in England stated the setting of regional target for renewable energy is something which should be encouraged¹⁴⁸.

314. The setting of regional targets for renewables was also supported in evidence from the major power companies. In its written submission to the inquiry, Scottish Power stated that "they...would support a system of regional targets similar to that proposed for England"¹⁴⁹.

315. However, the need for a clear renewable energy policy goes beyond the issues of planning and regional targets. If Scotland is to develop its renewable economy, then government must draw together and set out all the necessary strands of policy required to achieve this. In areas such as economic strategy, enterprise and business growth, education and skills development, social and community development and planning guidance, a holistic approach to policy needs to be developed in order to build a thriving renewable economy. Many of the tools to develop such a strategy are already in place.

316. The Forum for Renewable Energy Development in Scotland (FREDS) was established by the Executive in October 2003 to bring together government, the industry and academia in order to drive forward the development of the renewables economy in Scotland. FREDS now has sub groups looking at biomass development and also at the development of marine technology, which

is one of the areas with greatest economic potential for Scotland.

317. The Committee welcomes the establishment of FREDS as an important mechanism for driving the renewable sector forwards. There is potential for FREDS to expand and address some of the other pressing issues in the Scottish renewables sector, and in particular the Committee recommends that FREDS addresses market incentivisation.

318. It is very clear that the current growth in onshore wind farms will continue in Scotland for the foreseeable future. Hence the problems over planning and public objections will also continue and, in the opinion of the Committee, there is a growing risk that the wind farm debate will undermine public confidence in the entire renewable sector. If Scotland is to make the most of its renewable potential the support and active participation of the public will be vital. The Committee believes that the Executive needs to develop a mechanism which can draw together all the various strands of the current debate on onshore wind farms so as to inform the policy making process. This will be vital in counteracting scepticism towards the renewables sector in the minds of the public.

319. The Committee recommends that the Scottish Executive develops a clear policy to ensure communities in Scotland gain the maximum benefit from the renewables sector.

320. If Scotland is to grow its renewable economy then one of its most important renewable assets will be its people. Education and skills development policy must be formulated so that Scotland achieves the maximum benefit from renewables. This is a point highlighted by Scottish Enterprise in their written evidence to the inquiry that:

"there are concerns at the low number of engineering graduates entering the energy industry owing to perceived lack of future career opportunities. For example, the bulk of students studying grid management are from overseas countries and therefore less available for employment. In Scotland in 2001 it is thought that only 6 students graduated in specialist energy engineering. Without the right support for education and training of a kind developed to encourage teachers in key disciplines, we could face a continued lack of new graduates available for work in the industry."

321. Education will also be vital if Scottish society is to meet the energy challenges of the 21st century. Today, just as it is vital that individuals take responsibility for their health, so people must also be encouraged to take personal responsibility for the energy they consume. The attitude of hitting the switch and expecting the lights to come on, but objecting to any power generating development which is within visible distance, is still all too prevalent. In our modern technologically-driven economy we take energy for granted. Indeed, almost all of the evidence collected for this inquiry and the production of this report was carried out via electronic means, which required the consumption of electricity.

322. The need to change public attitudes was summed up by Dr Robin Wallace of the Institute of Energy system when he stated that:

"In primary, secondary and tertiary education and among the public at large, we need to move energy efficiency and sustainable energy sources further forward in people's minds so that they are higher up people's personal, domestic and social agendas"¹⁵⁰.

323. Responsibility for the energy we consume, how that energy is generated, the impact it has on

society and the climate are key message which must be brought to the forefront of public debate.

324. By way of various pieces of UK legislation, Scottish Executive policy, the electricity market, the regulatory system, the privatised power companies and users of energy, a de-facto renewable energy policy already exists in Scotland. Given this situation, the need for a clear and coherent policy which will address all of the complex elements of the energy equation in a sophisticated manner, is all the more urgent.

325. The Committee recommends that the Scottish Executive develops a Scottish Energy Policy as soon as possible.

326. This energy policy should seek to shift the focus from large onshore wind farms to other forms of power. It should also seek to map out how Scotland will develop its renewable energy economy over the next two decades, with actions which will be required across various areas of Executive policy. The policy should seek to establish the tools by which Scotland can engage with the ever-changing energy market to proactively adapt public policy to achieve the goals of a renewable economy.

327. The Committee recommends that Scottish Ministers should make regular ministerial statements to the Scottish Parliament on the Scottish Energy Policy.

328. It is anticipated that a Scottish Energy Policy would contain a variety of targets, including for instance targets for increasing overall economic benefit for Scotland; increased numbers of jobs for Scotland; increased research and development investment in Scotland's universities, improved public transport and improved energy efficiency in public and private housing and industry. The Ministerial statement should cover all of these aspects in addition to reporting on progress against UK targets and against the 2020 target of 40% renewable electricity generation. This would provide the Parliament with a regular opportunity to scrutinise the Executive's actions in delivering the Scottish Energy Policy.

Footnotes

⁸⁶ Biomass is anything derived from plant or animal matter inc' agriculture and forestry waste/residues or energy crops - DTI White Paper 2003

⁸⁷ Written submission from the Scottish Coal Company Limited

⁸⁸ The long-term storage of carbon CO₂ in the forests, soils, ocean or underground in depleted oil and gas reservoirs, coal seams and saline aquifers

⁸⁹ Combined Heat & Power (CHP) is a system of simultaneous generation of usable heat and power (usually electricity) in a single process, thereby discarding less wasted heat. Large scale CHP stations generate electricity for distribution and also heat water for domestic use. This is supplied to domestic customers through large scale district heating systems.

⁹⁰ Mr Chris Ballance MSP, 30 March 2004, Official Report column 837

⁹¹ The Scottish Coal Company Ltd, written submission

⁹² Mr George Harper, Argyll & Bute Council, 20 January 2004, Official Report column 414

⁹³ Mr George Harper, 20 January 2004, Official Report column 414

⁹⁴ Written submission from Argyll and Bute Council, page 3

⁹⁵ Questions from the Convener to Argyll and Bute Council, 20 January 2004, Official Report column 428

- ⁹⁶ Dr Gary Connor, Scottish Energy Environment Foundation, 23 March 2004, Official Report column 797
- ⁹⁷ Written submission from Buccleugh Biofuels
- ⁹⁸ Written submission from the Westray Development Trust, page 10
- ⁹⁹ Information on Orkney College's agronomy institute is available at:
<http://www.agronomy.uhi.ac.uk/>
- ¹⁰⁰ see for example Official Report column 729 onwards
- ¹⁰¹ Written submission from Scottish Energy Environment Foundation, table 1, page 3
- ¹⁰² Maf Smith, Scottish Renewables forum, 20 January 2004, Official Report column 450
- ¹⁰³ Maf Smith, Scottish Renewables forum, 20 January 2004, Official Report column 450
- ¹⁰⁴ Written submission from Scottish Enterprise, page 8
- ¹⁰⁵ The Unst Partnership was established 2000 by the Unst Community Council, Shetland Islands Council and Shetland Enterprise to stimulate the economic regeneration of Unst. More information on the Unst Partnership can be seen at: <http://www.unst.shetland.co.uk/frame.html>
- ¹⁰⁶ Elaine Hanton, Highland and Island Enterprise, 2 March 2004, Official Report column 637
- ¹⁰⁷ Deputy Minister for Enterprise and Lifelong Learning, 30 March 04, Official Report column 826
- ¹⁰⁸ Deputy Minister for Enterprise and Lifelong Learning, 30 March 04, Official Report column 826
- ¹⁰⁹ Written submission from the Scottish Renewables Forum
- ¹¹⁰ David Sigsworth, Scottish and Southern Energy, 20 January 2004, Official Report column 445
- ¹¹¹ Oral Evidence, 20 January 2004, Official Report column 430 and 431
- ¹¹² kV, Kilovolts
- ¹¹³ David Sigsworth, Scottish and Southern Energy, 20 January 2004, Official Report column 431
- ¹¹⁴ Supplementary letter from Scottish and Southern Energy, 13 January 2004
- ¹¹⁵ Written submission from Highland Council, page 4, paragraph 4
- ¹¹⁶ Ofgem, the Office of Gas and Electricity Markets, is the statutory market regulating authority for the UK energy market.
- ¹¹⁷ Written submission for the Department of Trade and Industry, page 5, paragraph 17
- ¹¹⁸ Charles Davies, National Grid Transco, 16 March 2004, Official Report column 720
- ¹¹⁹ Dr Lewis Dale, National Grid Transco, 16 March 2004, Official Report column 721
- ¹²⁰ "Building the Energy Internet", the Economist. Technology Quarterly 11 March 2004
- ¹²¹ Department of Trade and Industry White Paper 'Creating A Low Carbon Economy' February 2003, paragraph 1.6
- ¹²² Department of Environment, Food and Rural Development statistics 2003:
<http://www.defra.gov.uk/environment/statistics/eiyp/pdf/eiyp2003.pdf>
- ¹²³ Department of Trade and Industry White Paper 'Creating A Low Carbon Economy' February 2003, paragraph 1.29
- ¹²⁴ Department of Trade and Industry White Paper 'Creating A Low Carbon Economy' February 2003, table 2.1, page 26
- ¹²⁵ SPICE briefing 03/89 'Renewable Energy'
- ¹²⁶ Securing a Renewable Future - Scotland's Renewable Energy, paragraph 10
- ¹²⁷ Deputy Minister for Enterprise and Lifelong Learning, 30 March 04, Official Report column 838
- ¹²⁸ Written submission from the Scottish Executive, paragraph 42
- ¹²⁹ Deputy Minister for Enterprise and Lifelong Learning, 30 March 04, Official Report column 836
- ¹³⁰ 27 April 2004, Official Report, columns 945 and 946
- ¹³¹ Steve Watson, ALIenergy, 20 January 2004, Official Report column 423
- ¹³² Steve Watson, ALIenergy, 20 January 2004, Official Report column 423 and 424

- ¹³³ Written submission from the Baywind Energy Co-operative, page 6
- ¹³⁴ Angela Duignan, Baywind Energy Co-operative, 16 March 2004, Official Report column 732
- ¹³⁵ Written submission from Highland and Island Enterprise, page 7
- ¹³⁶ Questions from Susan Deacon MSP, 16 March 2004, Official Report column 734 to 736
- ¹³⁷ Written submission for the Scottish Energy Environment Foundation, page 3, table 1
- ¹³⁸ Written submission for the Scottish Renewables Forum, page 2
- ¹³⁹ Mott Macdonald study, written submission from the Scottish Executive, page 5, paragraph 19
- ¹⁴⁰ TWh = Terawatt Hour. One Terawatt (TW) equals one million Megawatts (MW). One terawatt-hour represents one hour of electricity consumption at a constant rate of 1TW
- ¹⁴¹ [Key Scottish Environment Statistics 2003: page 1](http://www.scotland.gov.uk/library5/environment/kses03-01.asp) - www.scotland.gov.uk/library5/environment/kses03-01.asp
- ¹⁴² SPICE paper 03/89, page 1
- ¹⁴³ Written submission from British Energy, paragraph 3
- ¹⁴⁴ Dr Chris Anastasi, British Energy ,10 February 2004, Official Report column 571
- ¹⁴⁵ Dr Chris Anastais, British Energy ,10 February 2004, Official Report column 571
- ¹⁴⁶ Department of Trade and Industry White Paper 'Creating A Low Carbon Economy' February 2003
- ¹⁴⁷ Renewable Obligation (Scotland)
- ¹⁴⁸ Office of the Deputy Prime Minister - Planning Policy Statement (PPS) 22 can be viewed at: http://www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_025517.hcsp
- ¹⁴⁹ Written submission from Scottish Power, page 2, paragraph 1.10
- ¹⁵⁰ Dr Robin Wallace, Institute of Energy Systems, 6 January 2004, Official Report, column 343