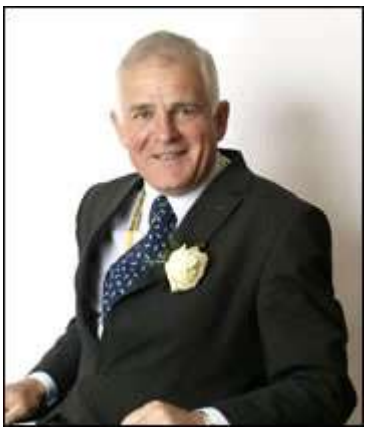
RENEWABLE HEAT ACTION PLAN FOR SCOTLAND: a plan for the promotion of the use of heat from renewable sources.

Ministerial Forward



I am delighted to be able to launch Scotland's Renewable Heat Action Plan, underlining this Government's commitment to make energy a priority in our Economic Recovery Programme while contributing towards our ambitious emissions reduction targets set out in the Climate Change (Scotland) Act 2009.

Heat constitutes some 50% of current energy demand in Scotland but for too long has taken a back seat in the renewable technology mix. However, this Government attaches a precedence to the development of the sector, as is evident in the Climate Change (Scotland) Act 2009, which mandates Scottish Ministers to produce a plan for the use of heat from renewable sources. This Action Plan fulfils that commitment and ensures that renewable heat is given the attention it requires.

The Plan highlights the need to utilise all technological options available, at a range of scales, to meet our 2020 target. In the short to medium term, industrial and commercial scale biomass will be key to developing the sector, while the domestic sector is more challenging and has the potential to contribute in the longer term.

This Plan will focus on actions to stimulate the market over the next 2 years.
There are considerable opportunities for growth in Scotland, particularly in terms of skilled trades people to manufacture, install and maintain the equipment. Ensuring that Scotland has the right skills in place is one aspect given focus within the plan.

The actions are not static and will be reviewed on a regular basis to make the Plan current and react to industry needs. A Steering Group, comprising a wide range of stakeholders have accepted an invitation as part of a sub-group of the Forum for Renewable Energy Development in Scotland to drive forward delivery. I look forward to working with the Group to implement this vital Plan.

Jim Mather MSP
Minister for Enterprise, Energy and Tourism

CONTENT

ANNEXES

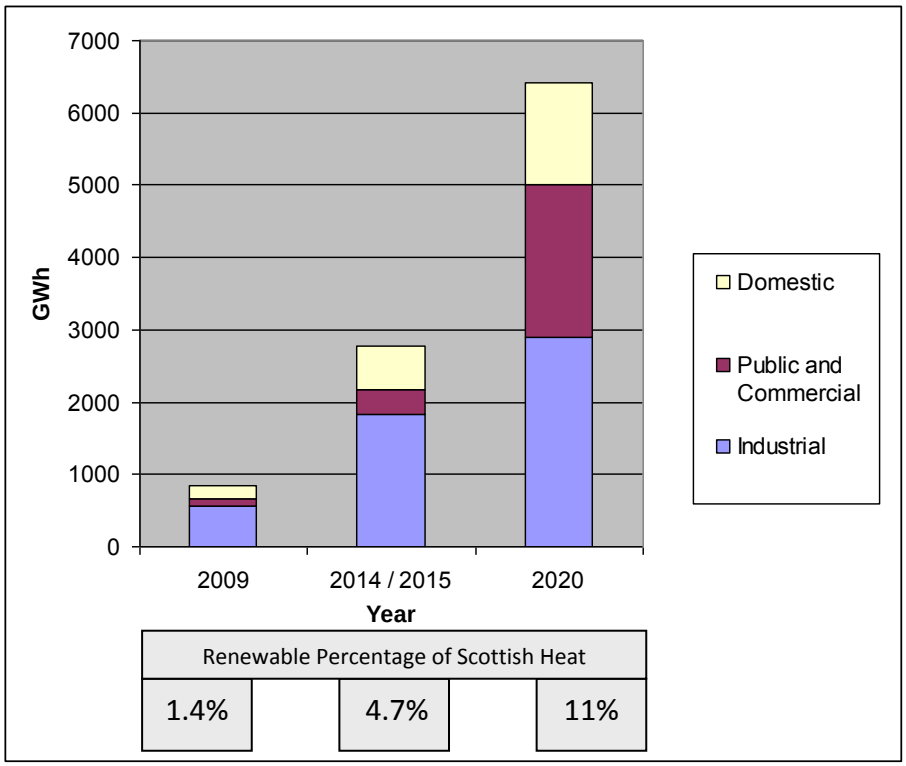
SECTION 1: EXECUTIVE SUMMARY

1.1 The Scottish Government has set a target of 11% of the heat consumed in 2020 to come from renewable sources. Scotland is currently producing some 1.4% of total heat use from renewable sources with around 70% of this used in the industrial sector. Overall, heat use is distributed between the main sectors as follows: industrial 31%, domestic 51% and commercial & public 18%.

1.2 Current projects in planning or with consent are likely to see the total portion of heat generated from renewable sources grow to nearly 3% in the near future, with a strong possibility that this could rise to around 4.7% with other known projects in various stages of development. Over 90% of our current renewable heat is generated from woody biomass, with energy from waste a rapidly developing sector. The availability of woody biomass in Scotland for energy generation is limited and a full range of technologies will be required to meet the target.

1.3 An initial focus on the industrial, commercial and public sectors could give large gains in the short to medium term, but to achieve the 2020 target and continue growth thereafter will require a strong focus on the domestic sector, particularly existing properties, as illustrated in the chart below. This will require retrofitting of micro-renewables and the development of district heating. A more challenging option to be considered for the domestic market is the use of biogas within the existing gas network.

Figure 1: Indicative level of heat usage by market sector



1.4 The introduction of a Renewable Heat Incentive (RHI) at a UK level, planned for April 2011, is critical and should lead to the rapid growth in the sector, and this Plan should be seen in the wider context. However, there is a need to take forward a wide range of actions to complement the RHI. This Action Plan will focus on those areas where Scottish Ministers have devolved responsibility, such as:

- Skills needs
- Provision of consumer information
- Building Scottish supply chain
- Leading by example

1.5 The Plan focuses on action required in the next 2 years to accelerate progress towards the 11% target. No one sector, technology, geographical focus or action alone will deliver the level of renewable heat required. Any quick wins will need to be followed up with substantial changes in the provision of domestic heat. Continuity of policy, effort and support is essential to deliver the carbon savings required.

1.6 Finally, this Action Plan continues and builds on previous Scottish Government support to the renewables sector. In particular, grants totalling some £6.6 million were awarded under the Scottish Biomass Support Scheme (2007/08) to support the transformation of the woodfuel sector in Scotland. More recently, in December 08 a new scheme to support biomass heat only projects was launched worth £3.3 million.

SECTION 2: PURPOSE AND STRATEGIC CONTEXT

This section sets out:

- **Purpose**
- **Strategic Context**
- **Related Energy Policy**
- **Environmental Impacts**
- **UK Context**

Purpose

2.1 This Action Plan seeks to promote the growth of the sector in advance of the main market mechanism, the UK wide Renewable Heat Incentive (RHI) which is due to launch in April 2011. It sets out a framework for activity, across a wide range of areas, which will contribute to meeting our 2020 heat target. Specifically it will:

- Give an overview of current position and where we need to get too
- Identify what needs to happen and by when to achieve targets
- Identify indicative milestone ambitions to 2020
- Focus on actions needed in the short-term (over the next 24 months)

2.2 Renewable heat is rightly in the spotlight and will play a key role in helping to address both climate change and renewable energy ambitions. Scotland is starting from a very low base, currently around 1.4% of our heat usage is from renewable sources. We cannot shy away from the scale of the challenge ahead and must make significant progress over the next few years.

2.3 A refreshed Steering Group has been established, chaired by an industry representative to oversee implementation of the Action Plan.

Strategic Context

Climate Change

2.4 The imperative for action to address climate change is driving policy development across a number of fronts. The Climate Change (Scotland) Act 2009[1] sets a target to reduce greenhouse gas emissions by at least 80% by 2050. The Act also sets an interim target of a reduction of at least 42% by 2020 and requires the Scottish Ministers to seek expert advice on what the highest achievable 2020 target is. The country is set for decades of unprecedented activity in this sphere.

2.5 The *Climate Change Delivery Plan*[2] sets out strategic options for delivering future emissions cuts. It identifies 4 transformational outcomes which will need to be substantially delivered by 2030 to put Scotland on the correct pathway to meet the 2050 target. One of these outcomes relates to renewable heat:

[1] Climate Change (Scotland) Act 2009 - http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact

[2] Climate Change Delivery Plan: Meeting Scotland's Statutory Climate Change Targets - http://www.scotland.gov.uk/Publications/2009/06/18103720/0

- A largely de-carbonised heat sector by 2050 with significant progress by 2030 through a combination of reduced demand and energy efficiency, together with a massive increase in the use of renewable or low carbon heating.

2.6 A Report on Proposals and Policies, as required by the Climate Change (Scotland) Act, will set out what we are going to do to achieve a series of annual emissions reduction targets up to 2022. The report must be published as soon as reasonably practicable after the annual targets are set (which must be done by 1 June 2010), and will be informed by this Action Plan.

2.7 The Climate Change (Scotland) Act also requires Scottish Ministers to report annually to the Scottish Parliament on Scotland's emissions and on the progress being made towards the emissions reductions. The first report on the 2010 target will be published in 2012. The emissions reductions which this Action Plan will contribute towards will be reflected in those reports.

Energy Pledges

2.8 Alongside the ambitious emissions reduction targets, Scottish Ministers have made a commitment to delivering 10 Energy Pledges which will be a key driver to meeting Scotland's target of 20% of total energy use from renewable sources by 2020. To assist in reaching this target, it is proposed that 11% of heat use will be from renewable sources. Section 4 will consider in more detail how the target will be achieved.

Energy Pledge 2 states:

- We will aim to build a commercially viable, diverse renewable heat sector in Scotland to deliver benefits to the wider public, through the implementation of our Renewable Heat Action Plan. This commitment is reflected in the Climate Change (Scotland) Act which requires the Scottish Ministers to produce and publish a plan for the promotion of the use of heat from renewable sources.

Related Energy Policy

2.9 This Action Plan should not be viewed in isolation. It continues and builds on previous Scottish Government funding and support to the sector. In particular:

Funding

- **£6.6 million** of grants awarded under the Scottish Biomass Support Scheme (2007/08) to support the transformation of the woodfuel sector in Scotland
- Launched a new scheme in December 2008 to support biomass heat only projects worth **£3.3 million**.
- RSA support of **£8.1 million** to Tullis Russell, Glenrothes towards a CHP biomass plant.
- RSA support of **£10 million** to UPM, Irvine towards CHP biomass plant

2.10 The earlier work undertaken by FREDS Renewable Heat Group which reported to Scottish Ministers in February 2008. The report made 23 recommendations ranging from setting a target to a review of financial incentives. The Scottish Government responded to that report in October 2008 as part of the consultation on a Framework for the development and deployment of renewables in Scotland[3].

Progress to date includes:

- Scottish Ministers have agreed formally with UK Ministers that they are to be consulted on the introduction of the RHI,
- Banded Renewables Obligation (Scotland) came into force as from April 2009,
- Scottish Government has a secondee from EU skills working as part of the Renewables team to ensure, and
- Air source heat pumps now eligible under the Energy Assistance Package in off-gas grid areas.

2.11 A full summary of progress is at Annex A. This work will be taken forward as part of this Action Plan.

2.12 In addition, it complements other related energy work currently being taken forward to put Scotland at the heart of Europe's low carbon energy revolution, including:

- *The Renewables Action Plan*[4] which identifies collective actions by Government, its agencies and partners, to ensure at least 20% of Scotland's energy comes from renewables by 2020. the routemaps for renewable heat and bioenergy in the RAP together can be read as a summary of this Action Plan.
- The Energy Efficiency Action Plan which is due to be published spring 2010 will identify indicative energy savings, activities and actions needed from different sectors to contribute towards green house gas reductions. It will consider the role and place of low carbon equipment in the built environment for both heat and electricity generation and waste heat from non renewable sources for district heating. *'Conserve and Save: Consultation on the Energy Efficiency Action Plan for Scotland'*[5] was published on 8 October 2009 and will form the basis of the Action Plan.

[3] Making Scotland a leader in green energy: Draft framework for the development and deployment of renewables in Scotland - http://www.scotland.gov.uk/Publications/2008/11/05115324/0
[4] Renewables Action Plan – http://www.scotland.gov.uk/Publications/2009/07/06095830/0
[5] Conserve and Save: Consultation on the Energy Efficiency Action Plan for Scotland- http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ActionPlan

Environmental Impacts

2.13 An Environmental Report was published alongside the Renewables Action Plan (RAP) as part of the Strategic Environmental Assessment (SEA)[6] process. Initial assessment of the RAP concluded that the Environmental Report should focus on renewable heat due to the shift in policy in this area and the introduction of a renewable heat target. The recommendations in the report, coupled with the responses from the subsequent consultation process, were taken into consideration when designing our mitigation and monitoring framework as part of the environmental impacts detailed in Section 6 of this Action Plan.

UK context

2.14 The Scottish Government is working with the UK Government to play its part in meeting the EU Renewable Energy Directive which has recently been adopted. The directive requires the UK to achieve 15% of energy use from renewable sources by 2020. Scotland, in setting a 20% target, has aimed proportionally higher than the required contribution for the UK as a whole.

2.15 The UK Government are taking steps to introduce a UK wide financial mechanism to help support the take-up of renewable heat. The UK Energy Act includes enabling powers to design such a mechanism. Renewable heat is a mixture of devolved and reserved provisions (while Scottish Ministers have powers to promote renewable heat, any regulatory incentive administered by Ofgem will cut across reserved functions). Scottish Ministers have agreed with the UK Government that Westminster can legislate on their behalf in terms of the renewable heat incentive (RHI) but that Scottish Ministers will be consulted on its introduction to ensure specific Scottish interests are taken into account in the design of the scheme. The initial consultation on this incentive will take place towards the end of 2009.

2.16 This Action Plan will focus on those areas where Scottish Ministers have devolved powers, such as, skills needs, consumer information and heat mapping at a local authority level, all of which will complement the RHI to be introduced across the UK. **The RHI is seen as the main mechanism to accelerate the rapid growth needed to reach the Scottish, UK and EU renewable energy targets.**

[6] Renewables Action Plan: Strategic Environmental Assessment - http://www.scotland.gov.uk/Publications/2009/07/01093638/0

SECTION 3: OVERVIEW

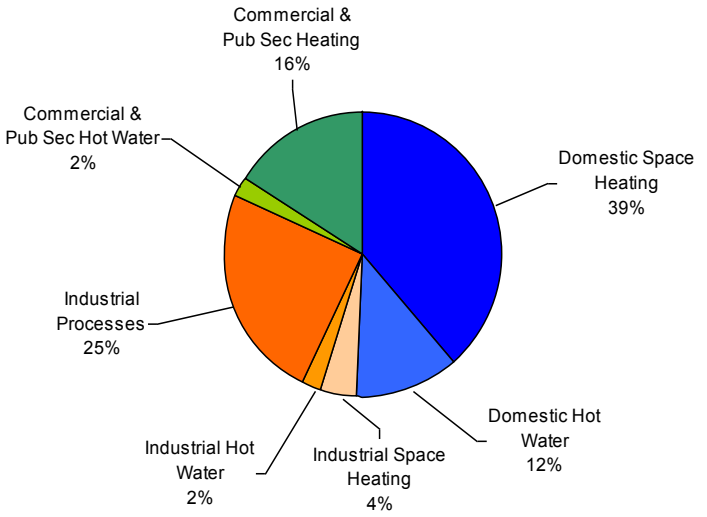
This section will:

- **Outline the current renewable heat usage in Scotland**

Current position

3.1 Heat (space and water heating) constitutes some 50% of the current total energy demand in Scotland, distributed between the following sectors:

Fig 2. Breakdown of heat demand in Scotland (2002 data)



Renewable heat usage in Scotland

3.2 In order to clarify the level of renewable heat usage in Scotland, the Scottish Government commissioned the Sustainable Development Commission (SDC) to research the current position. Their report is published alongside this Action Plan. The SDC's report only considers "active" renewable heat mechanisms. These include biomass combustion, including useful heat off-take from biomass combined heat and power (CHP), ground, air and water source heat pumps, and solar thermal panel. A number of other technologies can be classified as renewable heat sources, such as, fuel cell CHP units using biofuels to generate electricity and heat, and deep geothermal installations to access geothermal heat directly. However, the report did not find them in use in Scotland.

3.3 The SDC did find a number of installations using renewable electricity for heating but the energy produced by them is being considered as renewable electricity and does not count towards the heat target. Whilst these types of projects do not count towards the target, their importance as an option for heating, especially in more remote rural areas of Scotland, should not be underestimated. Therefore, the plan will consider heat in the widest sense and ensure that the needs of this sector are fully integrated into the process, which will be particularly important in terms of skills needs.

3.4 The findings at Table 1 show that the current level of installed renewable heat capacity and output in Scotland is about **1.4% (of the projected 2020 demand)** with the market fragmented between differing technologies and scales of application.

Table 1: Scottish Renewable Heat Capacity as at 31 March 2009

	2008/09 TOTAL CAPACITY		**2008/09 TOTAL OUTPUT**	
Biomass primary combustion & CHP	192.73	MW	722,609	MWh
Waste combustion (Energy from waste and landfill gas)	6.56	MW	52,074	MWh
Solar thermal	9.37	MW	6,666.0	MWh
GSHP	21.33	MW	55,454	MWh
ASHP	2.8	MW	8,022	MWh
WSHP	0.05	MW	123	MWh
TOTAL	**232.84**	**MW**	**844,948**	**MWh**

3.5 Other key findings include:

- The bulk of renewable heat capacity and output, over 90%, comes from biomass. Of this, the majority comes from large scale plants using forestry derived biomass.
- 68% of Scotland's renewable heat capacity and 74% of renewable heat output comes from 15 plants of 1MW+ size. All but one of these plants uses forestry derived biomass.
- 8 out of these 15 plants provide heat to the wood processing industry. These 8 large installations contributed around 62% of all renewable heat output.
- There is poor data available on the level of micro renewable heat, but SDC have estimated that microgeneration makes up 16.5% of current renewable heat output.
- While approximately 14% of renewable heat capacity comes from solar thermal panels and heat pump installations, only 8% of output comes from these sources.
- Approximately 10% of renewable heat output comes from domestic biomass use. However SDC consider that the overall capacity of domestic biomass is a much higher percentage; which highlights both low levels of use and high inefficiency.

SECTION 4: TARGETS

This section covers:

- **Background and analysis**
- **Interim milestones**
- **UK heat target**

Scotland's Renewable Energy Targets

4.1 Scotland is committed to achieve a headline target of 20% of total Scottish energy use from renewable sources by 2020, which is made up of:

- Electricity – 50% of gross electricity consumption from renewable sources with an interim target of 31% by 2011.
- Transport – 10% for renewable transport. Consistent with overall EU approach.
- **Heat – 11% of heat usage to be met from renewable sources.**

4.2 Achieving the renewable heat target will also be critical to achieving the statutory targets set in the Climate Change (Scotland) Act 2009. Specifically, renewable heat and energy efficiency will contribute to achieving the required reduction in emissions from housing and non-domestic buildings of 4.3 MtCO2e in 2020[7]. This Action Plan does not report emissions savings from renewable heat directly. The Scottish Government is in the process of producing a Report on Proposals and Policies, due for publication in June 2010. This will identify the emission abatement expected from the various policies and economic instruments in Scotland that will contribute towards the 42% emission reduction target. This Action Plan is intended to provide the guidance and actions required to meet the renewable heat targets, and the future updates of this Action Plan will comment on the progress of the emission reductions identified from these policies.

Renewable Heat Target

4.3 The target for renewable heat energy in 2020 has been set at 6,420GWh (or 2.07 GW of installed capacity) this equates to 11% of the total Scottish heat demand which is forecast to be in the region of 60,089 GWh (60.1 TWh) by 2020. Additional comment on the data relating to these figures is available at Annex B.

Interim Milestones to 2020

4.4 As mentioned in Section 3, the current level of renewable heat usage is around **1.4%** (of projected 2020 demand). The SDC report estimates a near doubling of capacity can be expected from plant under construction if all projects remain on

[7] The Scottish Government's *Climate Change Delivery Plan*, *Table 1*, *June 2009*, indicates that a reduction in emissions of 4.3 MtCO2e is required from the heat sector between 2006 and 2020. This is equivalent to an emissions reduction in the (non-traded) Heat sector of 51% from 1990 levels, and is the contribution required from Heat in order for Scotland to reduce total emissions by the 42% required in the Climate Change (Scotland) Act by 2020. However, the analysis assumes that the EU moves from a 20% to a 30% target so that sectors governed by the EU Emissions Trading System (the "traded sector") - electricity and heavy industry - achieve greater reductions. If the EU were not to move to a 30% target greater reductions in the non-traded sector, including in heat, would be necessary.

track then output in 2009/10 is estimated at **2.7%**. As for future projections, SDC identified a number of projects at various stages of planning which could bring the total to around **4.7%** (of projected 2020 demand)**.** This includes a number of energy from waste plants.

4.5 Based on these findings the SDC is confident that Scotland **will be able to meet the 11% renewable heat target**, if:

- the RHI is introduced as planned in April 2011, and
- changes in waste policy are implemented which are likely to further discourage land filling of commercial and municipal wastes in favour of reduction, reuse, recycling, composting and thermal treatment.

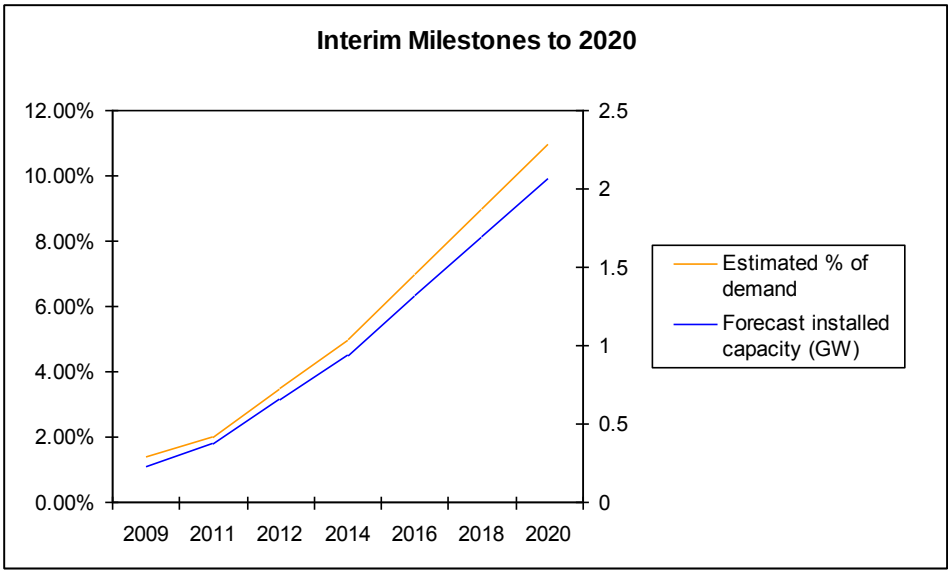
4.6 Using the findings from the SDC report and Scottish Government estimates, indicative interim milestones towards the 2020 target are provided at Table 2 and Figure 3. The figures take into account the levels of heat demand in the domestic, commercial & public and industrial sector of 51%, 18% and 31% respectively. Other factors include different fuel usage, fuel type and usage and efficiency.

Table 2: Interim milestones ambitions to 2020

Year	Estimated Percentage[8]	Forecast Installed Capacity		GWh Used
Actual 2009	1.4%	0.23	GW	829
2011	2.0%	0.38	GW	1170
2012	3.5%	0.66	GW	2045
2014	5.0%	0.94	GW	2920
2016	7.0%	1.32	GW	4090
2018	9.0%	1.70	GW	5255
2020	11.0%	2.07	GW	6420

Fig 3: Interim milestones ambitions to 2020

[8] Indicative percentage growth of renewable heat, based on Scottish Government assumptions of potential uptake and baseline assumptions identified in the SDC Renewable Heat Report.



4.7 Whilst the analysis done by the SDC suggest that Scotland can be relatively confident reaching its 2020 renewable heat target, this does not mean that we can be complacent. There is a need to continue to drive forward action on a number of fronts to ensure we reach or exceed our targets. The sector is at an early stage and strong leadership from Government will be essential across a number of policy areas to provide the right environment for stakeholders to invest.

UK heat target

4.8 The UK Renewable Energy Strategy, published on 15 July 2009, sets out the UK Government's approach for meeting the legally binding 15% target for renewable energy. The individual targets which make up the overall target are: electricity over 30 %, **heat 12%** and transport 10%.

4.9 As Scotland's comparative advantages will differ from the UK as a whole, the targets for heat, electricity and transport differ at a national level.

4.10 The UK Renewable Energy Strategy identified that in order to achieve the 15% of renewable energy required by 2020. The following contribution would be required from heat, transport and electricity.

Table 3: UK Renewable Energy Strategy Projected Targets[9]

(TWh)	2008		2020	
	All Energy	Renewable Energy	All Energy	Renewable Energy
Electricity	387	22	386	117
Heat	711	7	599	72
Transport	598	9	605	49
TFEC[10]	1,695	39	1,590	239

[9] UK Renewable Energy Strategy, July 2009. Available at: http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/res/res.aspx

[10] 'TFEC' – Total Final Energy Consumption, totals may not sum due to rounding.

4.11 The table above demonstrates that under the UK central projections total heat demand is expected to fall by 112 TWh between 2008 and 2020. This implies that for the UK to meet the 12% renewable heat target by 2020 renewable heat must generate 72 TWh in 2020.

4.12 As established in this Action Plan the Scottish renewable heat target equates to 11% of projected Scottish heat demand in 2020, based on Scottish Government analysis this would required 6,420 GWh (6.42 TWh) of generation to achieve this target.

• UK Target of 12% Renewable Heat	72 TWh
• Scottish 11% Renewable Heat Target	6.4 TWh
• Scottish share of UK Target	8.9%

4.13 The corresponding projections for total heat energy demand for the UK and Scotland, suggest that Scotland's 11% target would equate to just under a 9% share of the UK target. This is **marginally larger** than Scotland's pro-rata population share of the UK target.

4.14 One key point that these figures highlight is that total heat energy consumption in 2020 will be a major contributing factor in meeting the renewable heat targets. If Scotland's heat consumption figures fall as a result of energy efficiency measures, then it would mean that either it will be easier to achieve the 11% target or that the level of installed renewable heat capacity in 2020 would account for, in percentage terms, proportionately more than is currently estimated. More detailed analysis surrounding energy efficiency measures and the impact on Scotland's energy consumption is contained within the Scottish Government consultation document on the Energy Efficiency Action Plan that was published on 8 October 2009.

4.15 It should be emphasised that the interim milestones towards our 2020 goal are not caps. Also, the SDC report indicates Scotland is well placed to meet and even exceed its target.

SECTION 5: FOCUS TO 2020

This section will cover:

- **Routemaps**
- **Market sectors**
- **Sources of renewable heat**
- **Case studies**
- **Beyond 2020**

Routemaps

5.1 As mentioned in section 2, sectoral routemaps for heat and bioenergy are included in the Renewables Action Plan which was published in July 2009. The routemaps were produced after consultation with stakeholders and form the basis for this Action Plan, along with the SDC Report. **The routemaps are summary versions of this more detailed Action Plan**. The headline aspirations of the routemaps are:

Vision

5.2 To build a commercially viable, diverse, renewable heat industry in Scotland in support of our 2020 renewable energy target and help tackle climate change. In doing so, to maximise the contribution of sustainable biomass to meet renewable heat target and reduce carbon emissions.

Ambitions

5.3 To at least meet the 11% target by 2020 through:

- having space heating and hot water from renewable energy sources recognised as the first choice option for new developments in areas off the gas grid, and maximising opportunities for retrofitting;
- having space heating and hot water from renewable energy sources representing a cost effective option in the rest of the country;
- supporting the development of integrated local and regional community energy and utility cross-sectoral partnerships;
- creating a flexible, future-proofed delivery infrastructure, allowing for technological, financial and structural innovation;
- developing a supportive policy, planning and regulatory framework
- substantial growth of bioenergy potential in Scotland in harmony with environmental and air quality obligations;
- substantial increase in the uptake of heat from a range of bioenergy sources across the domestic, commercial and industrial sectors

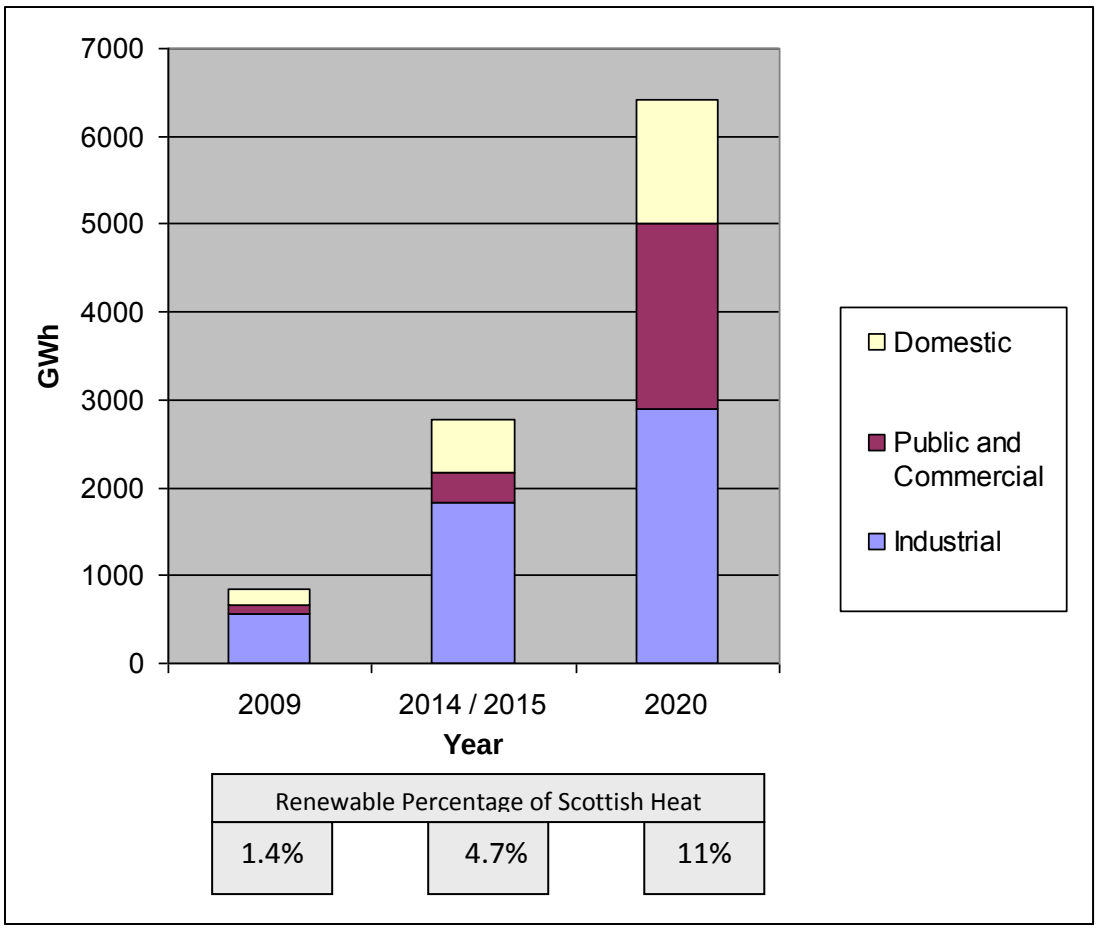
Market sectors

5.4 All technological options and scales will need to play a part in the delivery of renewable heat, from microgeneration through to large scale industrial. The routemaps consider the heat sector at a strategic level. However, is it essential to drill down to the individual market sector level (domestic, commercial & public

sector and industrial) to gain a better understanding of where support needs to be focussed in each sector in the short, medium and long term for maximum impact.

5.5 The diagram below *estimates* the level of renewable heat that each sector will contribute towards the 2020 target based on various assumptions. There is no substantive evidence to suggest that this will be the actual take up by the different sectors. It is the intention to further refine the data used in the future and work has already started. Part of the work that the SDC did for the Scottish Government included a database of all significant heat installations in Scotland and the database is updated on a regular basis. The introduction of a renewable heat incentive in April 2011 should further enhance the availability of data.

Figure 4: Indicative level of heat usage by market sector



Notes: (1) The 2009 data is based on actual installations and output figures recorded in the Scottish Government/SDC Renewable heat database.
(2) The interim ambition for 2014/2015 takes into consideration the renewable heat sources under construction, consented and in planning and assumes a similar sector breakdown to the 2009 levels.
(3) The 2020 target ambition is illustrated by sector using DECC estimates of contributions expected from each sector and the Scottish Government Renewable Heat Target.

5.6 Figure 4 above provides an illustrative estimate of the requirements from each sector to meet the Scottish renewable heat target. The key points are:

- *industrial sector* – may contribute the largest percentage share of the 2020 target, estimated at around 45%.
- *commercial sector* – expected make steady progress towards 2020 target, estimated percentage share is 33% which is in line with its share of heat demand.
- *domestic sector* –percentage share of the 2020 target is low, estimated to be around 22%, compared to its share of heat demand, which is 51%. Expected to increase percentage share after 2020.
- industrial and commercial users are the key target market in the short term, but with some 50% of Scotland's heat demand being in the domestic sector it is essential to initiate change in this area as quickly as possible, with a particular focus needed to tackle the 2.4 million existing properties.

Main sources of heat for each sector

5.7 The table below gives a summary of where the main sources of heat are *likely* to come from for each sector up to 2020. The same disclaimer applies as with the percentage market split assumptions: these are estimates and will be further refined as and when more robust data becomes available.

Table 4: Main Sources of Heat to 2020

Sector	2009	2012	2020
Industrial	Woodchip	Woodchip Energy from Waste Anaerobic Digestion Pellets	Woodchip Energy from Waste Anaerobic Digestion Pellets Ground Source Heat Pumps Air Source Heat Pumps
Commercial and Public	Woodchip	Woodchip Pellets Ground Source Heat Pumps Air Source Heat Pumps Solar Thermal	Woodchip Pellets Ground Source Heat Pumps Solar Thermal Air Source Heat Pumps Biogas (direct injection)
Domestic	Log Woodchip Pellet Ground Source Heat Pumps Air Source Heat Pumps Solar Thermal Biomass District Heating	Log Pellets Ground Source Heat Pumps Solar Thermal Air Source Heat Pumps Biomass District Heating Anaerobic Digestion Biogas (direct injection)	Pellets Air Source Heat Pumps Log Solar Thermal Biomass District Heating Ground Source Heat Pumps Biogas (direct injection) Water Source Heat Pumps Combined Heat & Power

Key points:

- In the short to medium term, systems which use woody biomass are likely to be the most frequently employed technologies across all sectors.
- Energy from waste, in all its various forms, represents a rapidly developing sector.

- Moving towards 2020 will see a wider range of technologies being employed across all sectors as the take-up of renewable heat increases.
- Urban and rural areas will have different needs. In rural areas off the gas grid individual solutions based on microrenewables such as biomass, solar thermal and heat pumps will be particularly important. In urban and semi urban locations there are greater opportunities for the use of renewable based district heating, and potentially biogas.

5.8 The above analysis is reinforced in the SDC Report, the Climate Change Delivery Plan and RAP which highlight the following areas as having a key role in reaching our renewable heat target for 2020:

SDC Report

- Woodfuel, including CHP. There is very significant potential for a substantial increase in small to medium heat-only biomass. Meeting a further 2-3% of heat from small to medium scale installations by 2020 is feasible.
- Energy from Waste. Thermal treatment of waste will have an important role to play in providing a sustainable means of waste treatment and energy generation. However, given that in waste policy the priority will remain action to reduce, reuse and recycle waste, SDC's assumption is that if 25% of suitable wastes (such as waste wood and other biological wastes suitable for anaerobic digestion) are used, this could provide just below 5% of Scotland's heating needs.
- District heating. District heating already exists in locations throughout Scotland, and there is growing interest in the development of schemes in many parts of Scotland – both heat only and combined heat and power. Action to support district heating should be considered as part of the Government's work to stimulate low carbon heat sources. In the short term, district heating is likely to be developed at a smaller scale and in more rural and semi rural locations, or alongside energy from waste developments, and should be supported as part of any overall action on low carbon heat. Post 2020, switching to large scale district heating schemes in more urban areas to renewable heat is likely to occur.
- In addition to the evidence given by the SDC Report, the Energy Saving Trust have produced a summary of the benefits and potential of distributed energy generation at the small community scale in Scotland[11]. The report outlines the potential for all relevant renewables technologies at a district level, including district heating.
- Micro-heat**.** To achieve the 2020 target, the majority of heat will come from large to medium scale installation. The shift to micro scale will take time as a typical boiler is only replaced every 15 years. Over the next 10 years a shift change will need to take place regarding the use of fossil fuel systems in new

[11] Power in numbers: the benefits and potential of distributed energy generation at the small community scale in Scotland http://www.theenergysavingtrust.com/corporate/Corporate-and-media-site/About-us/Our-public-policy-work/Renewables-and-distributed-energy

and refurbished homes. Forward trends indicate an increase in biomass heating of individual buildings becoming dominant in rural and some suburban areas, with waste or gas (supplemented by biomass) district heating dominant in urban areas, and solar thermal providing additional hot water in all situations. Heat pumps and electric heating will be a logical choice in very well insulated homes with minimal heat demand.

Climate Change Delivery Plan

- We need to exploit the cost effective opportunities to develop renewable heat in areas such as off-gas-grid domestic properties and the small business sector, and in use of local heat networks in new housing developments.
- We need to create the right conditions in which the choice of the householder or small business to invest in a low carbon heating source is no more unusual than purchasing a new gas or oil boiler.

Renewables Action Plan

Supporting Investments

- In the short term, maximise the opportunities presented through Scottish Government grant programmes.
- Ensure Scottish interests are taken into account when RHI is developed and introduced.

Building Scottish Supply Chain

- Provide advice and assistance to emerging and new start-up supply chain companies.
- Support business growth in, and diversification into, the renewable heat sector.
- Facilitate targeted inward investment where required to address renewable heat supply chain needs.

Skills

- Ensure the work carried out by the Scottish Renewable Energy Skills Group addresses the needs of the sector.
- Ensure renewable heat training incorporates guidance on energy standards.

Changing behaviours and guidance

- Provide clear concise information on key drivers, opportunities and support available to encourage both high heat users and the public sector to convert to renewable heat technology.
- Ensure best practice information on energy efficiency is available alongside renewable heat information.
- Facilitate opportunity to enable interested bodies to learn from early adopters, including publication of case studies.

Energy from Waste

- Enable the creation and growth of CHP and/or heat networks in relation to

energy from waste facilities with the aim of improving the competitiveness of business locations.

- Enforce thermal treatment guidelines to ensure energy from waste plants, treating any form of waste aim to capture the heat efficiently and seek markets for the heat.

UK Position

5.9 The UK Government published a *Renewable Energy Strategy*[12] in July 2009. The strategy states that UK heat supply is dominated by non-renewable technologies, with around 1% of total heat demand supplied by renewable sources. Independent analysis undertaken to inform the Strategy confirmed that there is a large, cost-effective, potential for biomass heat with particular significance in the non-domestic sector. Heat pumps could also play a more important role than previously estimated, while biomethane injection into the gas grid is also recognised as a technology which could offer significant levels of renewable heat.

Summary

5.10 We now have a good understanding of how the sector is likely to develop over the short to medium term. It presents a considerable opportunity for growth in the number of skilled trades people to manufacture, install and maintain the equipment e.g. boilers, heat pumps, solar collectors and insulated pipe work for district heating networks, along with further job creation through an anticipated increase in demand for biomass. It is therefore important to ensure that there is the capacity to provide the necessary professional services including designers, specifiers, building service engineers and planners.

5.11 The initial capital cost for purchase and installation of the required equipment can be quite considerable compared with fossil fuel systems, particularly district heating networks. This represents both a barrier to uptake, and an opportunity for business in driving innovation on cost reduction. Financial assistance to support renewable heat technologies is currently provided through a number of Scottish Government grant schemes. Further support, is provided under the Renewable Obligation where biomass CHP plants receive 2 Renewable Obligation Certificates of electricity per MWh generated. The introduction of the RHI which is proposed for April 2011 should help to stimulate demand at the scale necessary to meet the 2020 target.

[12] UK Renewable Energy Strategy - http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/res/res.aspx

Case Studies: Examples of Scottish Government supporting renewable heat across market sectors

Tullis Russell, Markinch, Glenrothes: Biomass Plant
A new 45 megawatt combined heat and power biomass plant in Markinch, Glenrothes, has been secured with Scottish Government Regional Selective Assistance (RSA) support of £8.1 million.
The joint venture will be built and operated by RWE npower Cogen, creating 30 new jobs, and will provide Tullis Russell with steam and electricity, safeguarding a further 540 jobs while reducing the paper mill's carbon emissions by around 250,000 tonnes each year. The new plant is a significant investment in Scotland and pays testament to our competitive advantage in terms of skills and workforce and the development of energy supplies that are cleaner, greener and economically competitive.

Newvalley Housing, Western Isles: Ground Source Heat Pumps
Muirneag Housing Association have installed ground source heat pumps and under floor heating in six out of 14 housing units constructed during the first phase of a new housing development in Newvalley, Stornoway, Isle of Lewis. A Scottish Government SCHRI grant of £62,246 contributed to the total capital costs of £115,431. Total installed capacity is 39kW. The heat pumps provide 100% of the space and domestic hot water requirements of each unit.

A Scottish & Southern Energy RSPB Green Tariff has been negotiated with the electricity supplier to supply the heat pump households, thus achieving a totally green power and heating system for the six housing units. Commissioning of the project includes a short technical introduction to each of the occupants regarding the proper and most efficient way to use heat pumps.

Aboyne Academy: Biomass Boiler
The Aboyne Academy site includes an academy, primary school, indoor swimming pool, library, theatre and community centre. Heat was provided by oil fired boilers at a cost of £90,000 for year 2004/05.

The oil fired boilers were replaced by a biomass boiler. The plant, consists of a 600kW Kohlbach boiler, complies with the EN 303 –5 standard and the Clean Air Act. The new boilers have been added to the building energy management system for remote monitoring, with the fuel coming from local sawmills (there are two in the vicinity).

Financial savings are anticipated to be in excess £20,000 per year which represents a 20% saving to Aberdeenshire Council, A Scottish Government SCHRI grant of £25,939 contributed towards the costs of the project.

Albyn Housing Association, Academy Lane, Alness, North Highland: Solar Thermal
Albyn Housing Society provides affordable and modern housing for those on low incomes in areas where there is a shortage of housing. This project sees the provision of 30 starter homes in regeneration areas in Alness, Easter Ross, which

includes 28 solar arrays installed by Inverness based company Everwarm (North) Ltd.

108 residents will benefit from properties with a significant proportion of their hot water requirements, lower heating costs and reducing CO2 emissions. The total cost of the project was £57,887 which included a Scottish Government SCHRI grant of £23,115 and match funding from Communities in Scotland of £34,672. Estimated carbon savings are 151.6 tonnes of carbon each year, saving £7,661. Albyn Housing has set a leading example and provided a visible demonstration of what can be achieved.

Beyond 2020

5.12 The Climate Change Delivery Plan and the SDC report have made some assumptions about how the renewable heat sector might develop in Scotland up to 2050. The key points are:

- the transformational outcome for the heat sector will be a largely de-carbonised heat sector by 2050 with significant progress by 2030 through a combination of reduced demand and energy efficiency, together with a massive increase in the use of renewable and low-carbon heating.
- Meeting Scotland's 2050 carbon reduction target will require heating in Scotland to be almost zero carbon by that time.
- The focus needs to change to low carbon heat and move away from separating renewable and non-renewable heat. This will be critical to meeting commitments under the Climate Change (Scotland) Act 2009.
- It is likely that electricity generation will make use of 'waste' heat which will result in more localised forms of generation suited to CHP, and making use of generated heat.
- A significant proportion of industry and homes will likely be connected to city-wide heat mains, with heat a metered commodity like electricity or water.
- New sources of heat might include deep geothermal mines.
- Fuel cells may become the dominant type of generation for biomass CHP, possibly running on biogas that will be fed into existing gas network.
- Heat planning is likely to become a important role of local government and or possibly utilities
- In 2050 each unit of heat delivered to a building will go further – insulation will be such that heating demand in new homes will be less than 10% of the current average.

SECTION 6: ENVIRONMENTAL IMPACTS

This section will cover:

- **Environmental impacts**

Background

6.1 In developing the RAP a Strategic Environmental Assessment was undertaken. This was required as the delivery of actions identified within the RAP is likely to generate significant environmental effects as defined under the Environmental Assessment (Scotland) Act 2005.

6.2 An initial assessment of the RAP concluded that the Environmental Report should focus on renewable heat due to the shift in policy in this area and the introduction of a renewable heat target. The assessment has shown that the 11% renewable heat target has the potential to generate significant positive effects in relation to the climate change mitigation agenda. However, it did conclude that the emphasis on biomass as a key source of renewable heat could lead to some negative effects which could also arise at a local level.

6.3 The report proposes monitoring and mitigation measures to ensure that the benefits of the policy far outweigh its negative effects. The recommendations of this report, in conjunction with responses from the subsequent consultation, inform the following mitigation and monitoring framework outlined at Table 5 and 6.

Table 5: Mitigation measures

MITIGATION		
Measure	**Trigger**	**Responsibility**
More specific guidance on appropriate abatement measures / restrictions of certain technology, or local level design guidelines to avoid adverse effects on air quality may be developed as implementation of the plan progresses.	Air quality thresholds identified in sensitive urban areas or AQMAs being breached as a result of increased use of biomass.	Scottish Government and SEPA
Development of integrated siting, planting and land management guidance to avoid adverse primary and secondary effects on biodiversity, landscape, cultural heritage, water and soils. Such guidance should avoid duplicating existing guidelines, such as the UK Forestry Standard.	None identified at this stage given the strategic nature of the RAP. Further analysis will be required to define this as more specific plans are developed as a result of the routemap.	Scottish Government, Air Quality

Table 6: Monitoring Framework

MONITORING		
Measure	**Frequency**	**Responsibility/Reporting**
Evaluation of contribution of renewable heat to energy production in Scotland.	Annual	Reported as part of the Action Plan updates undertaken as a provision in the Climate Change (Scotland) Act.
Monitoring of air quality and further assessment of any issues arising from increased levels of biomass.	Continuous	Any updated guidance on air quality to be communicated to local authorities.
Review of land use change arising from increased levels of biomass feedstock production.	Review to recommend policy	Part of the provision in the Climate Change (Scotland) Act for Scottish Ministers to lay a land use strategy before parliament by 31 March 2011

6.4 The recommendations from the RAP Strategic Environmental Assessment consultation will also be summarised in a Post Adoption Statement to be published on the Scottish Government website in due course.

SECTION 7: ACTIONS

This section sets out:

- **Table of Actions**

7.1 As indicated at Section 2, this Action Plan has been produced in consultation with a wide range of stakeholders; this reflects the position that no one sector, technology, geographical focus or action alone will deliver the level of renewable heat required. **In order to reach our target, collaborative working between the public and private sector and Government will be required to build the necessary capacity to encourage expansion of the sector.**

7.2 The actions outlined at Table 7, have been compiled from the Renewables Action Plan, the detailed analysis contained in this document, and the wider climate change agenda – all of which have been subject to a high level of stakeholder engagement.

7.3 We are at the start of a journey. There is some uncertainty about how the sector will develop in future years. The introduction of the RHI at a UK level, planned for April 2011, is seen as the main mechanism to accelerate rapid growth in the sector. This plan does not contain all the answers, but for the first time we have good market data that provides a solid base from which to build on over the coming years.

7.4 The actions cover a wide range of policy tools and mechanisms which are grouped under the following categories.

- Information and Advice
- Skills
- Supply Chain
- Supporting Investment
- Policy and Regulation
- Technologies

7.5 The focus of activity is over the next 2 years but we will review on a regular basis to ensure that the plan remains relevant in a fast changing environment.

7.6 The actions incorporate both opportunities and tackling barriers to realise the overall vision: "*To build a commercially viable, diverse, renewable heat industry in Scotland in support of our 2020 renewable energy target and help tackle climate change.*"

Table 7: Actions

Information and Advice	Timescale	Lead Organisation
Key Delivery Partners: Scottish Government, Forestry Commission Scotland, Community Energy Scotland, Enterprise Networks , CoSLA, Energy Saving Trust, Carbon Trust, Scottish Renewables, FREDS, Biomass Energy Centre		
• Provide clear concise information on key drivers, opportunities and support available to encourage high heat users and public sector to convert to RH technologies.	End December 2010	Scottish Government, Enterprise Networks
• Consider findings from gap analysis work undertaken by Scottish Renewables and take appropriate action.	End March 2010	FREDS Renewable Heat Implementation Group
• Publish case studies which have received SG funding to enable interested bodies to learn from early adopters.	End December 2009	Scottish Government
• Woody Biomass - Provide support and advice through the Regional Advice Network (RBAN) key tasks: co-ordinate support/advice from other key agencies; undertake marketing programme, working with Biomass Energy Centre.	End December 2011	Forestry Commission Scotland
• The SDC have provided a database of all significant heat installations in Scotland. This will be updated on a yearly basis.	End December 2010	Scottish Government
• Promote wider awareness amongst high heat users of ESCo's and opportunities for new links to utilise renewable technologies	End December 2011	FREDS Renewable Heat Implementation Group
• Encourage the use of public building as anchor loads for CHP/DH by publishing case studies	End December 2010	Scottish Government, COSLA
• Publish guidance on the building integration of low carbon equipment highlighting potential impact on both new build and retrofit.	Summer 2010	Scottish Government
Skills	**Timescale**	**Lead Organisation**
Key Delivery Partners: FREDS Renewable Heat Implementation Group, Renewable Energy Skills Group,		
• FREDS Renewable Heat group to consider specific skills needs for renewable heat and to feed this into the Renewable Energy Skills Group (RESG)	End March 2010	FREDS Renewable Heat Implementation Group
• The Renewable Energy Skills Group (RESG) to consider renewable heat skills requirements as informed by the FREDS Heat Group. The focus of activity will be in the following areas: Labour Market Intelligence; Sector Recruitment and Attractiveness, Standards and Qualifications and Education and Training Provision.	End March 2010	Renewable Energy Skills Group
Supply Chain	**Timescale**	**Lead Organisation**
Key Delivery Partners: Scottish Enterprise, Highlands & Islands Enterprise, Scottish Government, Forestry Commission Scotland		
• Maintain progress against the actions identified in the Wood Fuel Task Force, keys tasks are: Improve accuracy of forecasting, and develop long-term		Forestry Commission Scotland

contracts and greater transparency in the market.		
Supporting Investment	**Timescale**	**Lead Organisation**
Key Delivery Partners: Scottish Government, UK Government, Carbon Trust, Local Authorities, Financial Institutions, Community Energy Scotland, Energy Saving Trust, Forestry Commission Scotland		
• Continue to provide funding through various grant programmes, including CARES, SBHS and SRDP to support renewable heat installations including district heating.	End March 2011	Community Energy Scotland/Forestry Commission Scotland
• Continue to provide enhanced support for ACT and biomass CHP via the RO	Banding introduced April 2009 with a commitment to end March 2027	Scottish Government
• Consider the need for a credit loan guarantee scheme to facilitate development of the sector	End December 2010	FREDS Renewable Heat Implementation Group
• Work with the Carbon Trust, through the Biomass Accelerator Programme, to target Scottish companies that are high heat users, with a view to getting them to switch to renewable heat	Complete 20 energy audits by end December 2009	The Carbon Trust
• Undertake a heat mapping pilot with Highland Council in conjunction with COSLA.	End March 2010	Highland Council
• Housing Association building programme - promote more flexible approaches to balancing capital and revenue costs of renewable energy systems	End December 2010	Local authorities
Policy and Regulations	**Timescale**	**Lead Organisation**
Key Delivery Partners: Scottish Government, Forestry Commission Scotland, UK Government, SEPA		
• Promote best practice and provide guidance on air quality.	End March 2010	Scottish Government, SEPA
• Commission work to explore feasibility of introducing permitted development rights for air source heat pumps	End March 2010	Scottish Government
• Consult with UK Government on the introduction of the RHI to ensure Scottish interests are represented.	April 2011	Scottish Government
Technologies, including EfW	**Timescale**	**Lead Organisation**
Key Delivery Partners: Scottish Government, Scottish Enterprise, private sector		
• Support development of AD through WRAP	End March 2011	Scottish Government
• Quantify how much energy from waste (including AD) can contribute to renewable heat generation in Scotland	End December 2009	Scottish Government
• Develop proposals for advancing Scottish innovation in relation to EfW technology	Scope out initial proposal by end December 2009	FREDS Renewable Heat Implementation Group

SECTION 8: DELIVERY, MONITORING AND REPORTING

This section will set out:

- **The role of Scottish Government**
- **Delivery of the Action Plan**
- **Linking with Climate Change Agenda**
- **Reporting Mechanisms**

Role of Scottish Government

8.1 The role of Scottish Government in delivering a low carbon energy revolution can be defined as follows:

Leadership

- Focus on driving progress and identifying and overcoming obstacles to energy generation, business success, jobs growth, and carbon reductions.

Coordination

- Coordinate and facilitate the highest degree of partnership working between the public and private sectors and reinforce the role of the Energy Advisory Board and its Renewable Energy sub-group (FREDS), as the "centre of gravity" for renewables in Scotland.

Communication

- Engage closely with the UK Government and the EU to ensure Scotland's needs and contribution are reflected in their policies.

Delivery of the Action Plan

8.2 A steering group, co-chaired by an industry representative and the Scottish Government, will oversee and coordinate delivery of the Action Plan. The group will meet twice a year to review progress. The full membership details of the Steering Group can be found at Annex D.

8.3 As well as promoting the delivery of the actions, the Group will continually review the market to determine further steps required to make progress against climate change and renewable energy targets, setting new actions where appropriate.

8.4 The Group will work strategically with the overarching FREDS group and the Energy Advisory Board to assist in meeting Scotland's overall renewable energy targets while delivering sustainable growth.

Monitoring

8.5 The Action Plan will focus on actions to stimulate the market over the next 2 years. Over this initial period, the Group will meet at least twice a year to review progress. After 2 years, the structure and membership of the Group will be reviewed.

8.6 The Steering group will establish various sub-groups to take forward the delivery of various Workstreams which will be developed from the Action Plan.

Reporting

8.7 As previously mentioned the Climate Change (Scotland) Act 2009 includes a provision on renewable heat. That provision mandates Scottish Minsters to produce a plan for the use of heat from renewable sources. The plan must, in particular:

- Set targets for the percentage of heat to be produced from renewables sources.
- Set a date by which the targets should be met.
- Describe how those targets will be reported on.

8.8 In the short term, the database provided by the SDC will be the mechanism for annual reporting of progress towards targets. In the longer term the introduction of the RHI should provide the mechanism for this.

8.9 The actions as outlined in Section 6 are not static and will be reviewed on a regular basis to keep them current and react to industry. This is to meet the provision under the Climate Change (Scotland) Act 2009 which states:

- Scottish Ministers must review the plan at least every 2 years. If changes are made, a revised plan must be published as soon as practicable thereafter.
- In addition, Scottish Ministers must make a statement to the parliament on the changes made.

ANNEXES

Annex A	Scotland's Renewable Heat Strategy: Recommendations to Scottish Ministers Renewable Heat Group Report 2008. update on progress
Annex B	Analysis and working assumptions behind renewable heat target
Annex C	Routemaps - Opportunities/ Actions
Annex D	Steering Group Membership
Annex E	Glossary of Terms and Acronyms Used
Annex F	References

Scotland's Renewable Heat Strategy: Recommendations to Scottish Ministers
FREDS Renewable Heat Group Report 2008

PROGRESS REPORT

Measure	Recommendation	Action taken
Devolved Responsibility And Renewable Heat	That the Scottish Government: • clarifies that it has devolved responsibility for the promotion of renewable heat in Scotland	• Confirmed that the promotion of renewable heat is a devolved issue. However the proposed RHI cuts across both devolved and reserved maters as the RHI will be funded via a levy on fuel fossil suppliers which is reserved.
Technologies	That Scottish Renewables: • produces a consumer information pack.	• SR produced a "Renewable Heat Practitioner Information Gap Analysis Report. The recommendations will be considered as part of the Action Plan
Heat Mapping	That the Scottish Government: • develops a consistent approach to heat mapping and disseminates this to all local authorities in Scotland.	• The Scottish Government will fund a Heat Mapping pilot to be undertaken by Highland Council. The terms of reference have been agreed and work tendered over summer 2009.
Targets	That the Scottish Government: • urgently conducts further analysis of the potential heat markets in Scotland to inform the identification of an appropriate target for renewable heat,	• Scottish Government confirmed 11% heat target.
Wider Heat Strategy	That the Scottish Government: • develops a wider heat strategy for Scotland. • as part of a wider heat strategy, supports and promotes district heating.	• Scottish Government is mandated under the Climate Change Bill to produce an Energy Efficiency Action Plan; the plan will consider waste heat from non renewable sources for district heating. The timescale for publication is December 2009.
Fuel Poverty	That the Scottish Government: • supports the roll out of renewable technologies within its Central Heating Programme, subject to the success of the current Renewable	• Evaluation of the Scottish Renewables Heating pilot published 19 November 2008 Air source heat pumps now eligible under the Energy Assistance

	Heat Pilot.	Package in off-gas grid areas.
Public Procurement	That the Scottish Government: • takes a lead in its own public procurement practices, and requires local authorities and other public bodies to do the same.	• The Scottish Procurement Directorate is developing a Sustainable Procurement Action Plan which will offer guidance on how procurement can be done sustainably. • Within current public procurement legislation it is possible for public bodies to specify renewable sources of heating in both new buildings and refurbishments, provided that they think doing so if likely to provide value for money on a whole life cost basis.
Heat from Waste	That the Scottish Government: • charges SEPA to prohibit the dumping of waste biomass from industrial and commercial processes to landfill. • puts in place a policy to prevent the combustion of any form of waste without the recovery of heat, via CHP and/or district heating. • undertakes to establish a fuel standard(s) for materials from waste derived sources to enable appropriate materials to be treated as non waste fuel.	• SEPA issued thermal treatment guidance which seeks to encourage that energy from waste plants treating any form of waste aim to capture the heat efficiently and seek markets for the heat.
Low Carbon Buildings	That the Scottish Government: • gives guidance which encourages use of renewable heat to meet the building regulations, as the energy standards are progressively tightened towards zero-carbon new buildings	• Improved energy standards within building regulations have increased the need to consider renewable heat as part of design solutions, with a range of solutions identified in guidance. Further improvements to energy standards scheduled for October 2010, with additional reviews proposed for 2013 & 2016/17. • Online publication of 'Low Carbon Equipment and Building Regulations: A guide to safe and sustainable installation'. Chapters on heat pumps and solar water heating to be published in late 2009, followed by biomass in 2010. • Provision of online 'Heat Supply Options Assessment Tool' to allow modelling of proposed

	• reviews all options for improving the existing building stock to maximise uptake of renewable heat and minimise heat demand. • promotes the value of CPD for all stakeholders in the property market to raise awareness.	new developments, comparing the costs of district heating and individual installations of low carbon equipment. [due September 2009] • The Climate Change Act introduces powers to require assessment of carbon and energy performance of existing buildings. Policy is still being developed on building improvement works recommended within such assessments but could include renewable heat solutions. • Building standards promote the need for developers to be aware of a range of energy options, including renewable heat solutions.
Air Quality	That the Scottish Government: • recognises the benefit of renewable heat technologies to improving air quality, particularly where they replace oil and coal heating. • ensures, air quality management does not disproportionately penalise biomass or other renewable technologies.	• guidance issued to local authorities in February 2009 to assist with assessing biomass planning applications • Minister for Environment wrote to local authority Chief Executives in June 2009 outlining Scottish Government • policy on air quality and biomass
Local Planning	That the Scottish Government: • supports the implementation of measures within SPP6 on the installation of microrenewables.	• An Order and Circular introducing permitted development rights for certain domestic microgeneration installations was introduced on March 2009. Research is underway to consider permitted development rights for domestic micro wind turbines and air source heat pumps which will report by the end of 2009. National Planning Framework 2 encourages use of heat from electricity generation, industrial processes and anaerobic digestion. The Climate Change (Scotland) Act 2009 places further non-domestic permitted development rights obligations on Scottish Ministers and requirements for greenhouse gas emissions policies on local

	• legislates to require local authorities and housing associations to promote and support district heating using renewable technologies.	development plans which we will take forward. • The requirement for on-site low and zero carbon equipment should be reviewed and probably removed from Scottish Planning Policy 6 (Renewable Energy) as the 'very low carbon' standards are introduced in 2013.
Renewables Obligation (Scotland)	That the Scottish Government: • amends the Renewables Obligation (Scotland) to allow ROC-banding in line with the proposals being considered under the UK Energy Bill; in particular to award double ROCs to biomass CHP schemes, and for advanced conversion technologies for waste, but only where this is based on CHP and/or district heating.	• Banded RO(S) came into force as from April 2009.
Financial Mechanisms	That the Scottish Government: • reviews ongoing work by the UK Government on financial mechanisms.	• Scottish Ministers have agreed with UK Government that Westminster can legislate on their behalf in terms of the RHI but that Scottish Ministers will be consulted on its introduction to ensure that specific Scottish interests are taken into account.
Continuing Professional Development (CPD)	That the Scottish Government: • runs CPD workshops and/or seminars involving the Royal Incorporation of Architects in Scotland (RIAS) and the Institution of Civil Engineers (ICE), to ensure that all players are in tune with sustainable development principles, give proper consideration to renewable heat, and fully implement planning and building standards.	• The Scottish Government has regular contact with these organisations and has issued a range of guidance. Please see progress at above for Low Carbon Buildings
Training	That the Scottish Government: • instructs the Scottish Funding Council, Sector Skills Council and Skills Agency to develop a co-ordinated training programme incorporating: microgeneration, energy efficiency, and renewable heat.	• The Scottish Government has seconded a person to co-ordinate the skills needs of the renewable sector, which will incorporate, microgeneration, energy efficiency, and renewable heat.
Best Practice	That the Scottish Government: • investigates the promotion of renewable heat within other countries to ensure benchmarking against best practice abroad, with a view to adoption of best practice, subject to statutory competence.	• The Energy Saving Trust and the Carbon Trust, whose activity in Scotland is funded by the Scottish Government, have a range of case studies available on their websites. In addition the

		Forestry Commission Scotland via is usewoodfuel website has a range of information on the use of biomass in heating.
General Awareness Raising	That the Scottish Government and the sector as a whole: • promotes the benefits of renewable heat in a coordinated and easily accessible fashion, including through web promotion by appropriate agencies and other general awareness raising activities.	• A wide range of information is available via the Energy Saving Trust, Carbon Trust and Community Energy Scotland (all funded by the Scottish Government) websites which promotes the benefits of renewable heat across all scales – domestic to large industrial. .

Renewable Heat Target

A target of **11%** (6420 GWh) has been set as the portion of heat energy to be supplied from renewable sources by 2020. This figure has been reached as a result of previously established targets for transport and electricity towards an overall combined target for renewable energy of 20%.

The Scottish Energy Study was used as a baseline for the heat and energy demanded in Scotland[13]. And forecasts to 2020 for Scotland were based on UK assumptions from the Energy White paper[14].

The renewable heat target is set ex post after the other renewable targets were established and is based on a forecast level of energy demand in 2020. An indicative view of how this target was established is reported below:

Table A: The Renewable Heat Target for 2020

(1)	Total Energy Demand in 2020	(Approx. 160 TWh)
(2)	20% Renewable Energy Target in 2020	(Approx. 32.1 TWh)
(3)	Less: 50% Renewable Electricity Target	(Approx. 22.2 TWh)
(4)	Less: 10% Renewable Transport Target	(Approx. 3.40 TWh)
(5)	**Equals: Renewable Heat Requirement**	**6420 GWh**

This output equated to around 11% of the 60.1 TWh (non-electric) heat demand projected for 2020.

To set a defined renewable heat target in 2020 required modelling based on a set of assumptions surrounding energy demand projections, renewable electricity and transport forecasts to 2020. There are a number of variables that can occur in the period to 2020 that could change the level of renewable heat supply required to meet the 11% target.

(1) Firstly, due to rapidly advancing energy policy it is difficult to forecast with any certainty the level of energy demand in 2020. Currently there are a range of projections however, no robust method can be established. Furthermore, these projections may not take account of the full extent of the energy efficiency improvements that will be installed in the period to 2020.

(2) There is no robust quantified estimate for the level of generation output required to meet the 20% renewable energy target in 2020, the modelling used to forecast the renewable heat share makes assumptions of energy output based on Scottish Government modelling and UK growth rates.

[13] Scottish Energy Study: Volume 1, Table 24.
http://www.scotland.gov.uk/Publications/2006/01/19092748/0
[14] Updated Energy and Carbon Emission Projections, The Energy White Paper, Feb 2008
http://www.berr.gov.uk/files/file39580.pdf

(3) In relation to the renewable electricity targets, there is the potential for Scotland to exceed these due to the significant natural energy resource potential that exists in Scotland. This would allow for Scotland to export an increasing amount of clean electricity. If renewable electricity significantly overshoots its target, this would present a situation where either renewable transport or renewable heat could fall marginally short of their respective target levels and the overall renewable energy target could still be achieved.

(4) Assumptions were made around the levels of output required from renewable transport, that relied on projections of Scotland achieving increased proportions of biofuels in transport petrol and diesel consumption, corresponding to targets set by the EU for member states.

(5) The combination of the points mentioned above suggest that the level of renewable heat output in 2020 may differ slightly from the indicated level in this Action Plan (6420 GWh). However as more detailed reporting becomes available, as a result of the RHI and other analysis, this will provide a more accurate view as to a more precise level of output required to achieve the 11% renewable heat target in 2020.

The points above highlight some of the underlying assumptions behind the figures contained in Table A and explain the variables that exist in estimating output required from renewable heat by 2020.

Installed Capacity

To give some indication of the levels of installed capacity required to meet the 11% (6,420 GWh) target set by the Scottish Government for 2020 some additional analysis was performed.

Based on Efficiency and Operating hours, the analysis suggests that to achieve 6,420 GWh of renewable heat energy by 2020, a forecast **2.07 GW** of installed capacity will be required

This takes account of the levels of demand in the Domestic, Service & Public and Industry sectors of 51%, 18% and 31% respectively. This breakdown of demand is subject to a degree of variation between sources, however the evidence used throughout the forecast calculations is consistent with FREDS[15]. The specific assumptions of sector demand used in the calculations can lead to a variation in the capacity and carbon emission results.

The following efficiency and operating hours were assumed in the background calculations for the renewable heat in the various sectors:

[15] FREDS, Scotland's Renewable Heat Strategy: Recommendations to Ministers, 2008 (Table 1)

Sector	Efficiency	Hrs/ann
Domestic	85%	2500
Service and Public	90%	5000
Industry	90%	8000

Source: Sustainable Development Commission Scotland, Renewable Heat in Scotland Report, May 2009

Current estimates from the renewable heat database suggest that to generate the 844,948 MWh of renewable heat output there is a total installed capacity in 2008/09 of 232.84 MW.

The projections of 2.07 GW installed capacity required for the 11% suggest higher installed capacity than would be the result from mathematical extrapolation from 2008/09 figures, however this takes into account the assumptions regarding efficiency and fuel use from the different sectors, as the Domestic and Service/Public sectors are expected to contribute an increasing share of the renewable heat in the period to 2020.

Summary of Routemaps – Opportunities/Action Section

Renewable Heat Focus for Action to 2020

Supporting developments
• Provide clear concise information on key drivers, opportunities and support available to encourage both high heat users and the public sector to give serious consideration to installing one or more of the most relevant renewable heat technologies. • Provide an opportunity to enable interested bodies to learn from early adopters by facilitating engagement between them, including publication of appropriate case studies. • Promote the heat options assessment tool to help developers to understand the opportunities and requirements for a cost effective district heating (DH) scheme and compare options for DH and individual installations of low carbon equipment, set in the context of a tightening of energy standards, as recommended by Sullivan report. Published on 22 June 2009 by Building Standards. • Enable the development of commercial renewable heat projects, linking available resources with potential users/locations in close proximity. • Ensure that best practice information on energy efficiency is available alongside renewable heat information provision.
Skills
• Ensure that work carried out by the Scottish Renewable Energy Skills Group addresses the needs of the renewable heat sector**.** • Identify solutions to any labour/skills barriers identified in the Scottish Enterprise baseline study into the Energy Supply Chain in Scotland with a view to developing a workforce with the capacity and skills necessary for exploiting opportunities in the renewable energy sector. • Ensure renewable heat training incorporates guidance on energy standards.
Building Scottish Supply Chain
• Provide advice and assistance to emerging and new start up supply chain companies. • Enable development and co-ordination of supply chains. • Support businesses growth in, and diversification into, the renewable heat sector. • Facilitate targeted inward investment where required to address renewable heat supply chain needs and explore opportunities to develop the skills base and manufacturing infrastructure for renewable heat technologies.
Supporting Investment
• In the short term: maximise the opportunities presented through the SBHS, WRAP, CARES, SRDP and, as appropriate, RSA support mechanisms, including demonstrator schemes for e.g. district heating and retrofitting in the domestic sector. • Continue to work closely with the Department of Energy and Climate Change (DECC) to highlight Scottish needs in the consideration of mechanisms to enable the wider use of renewable heat, in particular the introduction of the

RHI and the banded RO. • Link sources of venture capital with major commercial renewable heat developments, in particular supporting new business models and partnerships between private sector, local authorities and communities for the delivery of heat through district heating. • Consider the need for a credit loan guarantees scheme to facilitate development in the sector.
Technologies
• Ensure information on all technologies is available to enable end users to make an informed choice about the most appropriate technology for their needs. • Commission further work to explore the feasibility of introducing permitted development rights for air source heat pumps and wind turbines.
Building Regulations
• Consultation on change to energy standards in Technical Handbooks 2009.
Demonstration project*(s)*/Regional Champions:
• Draw on experience of others, such as Sustainable Glasgow, to promote best practice. • Seek to access European expertise on renewable heat; develop collaborative projects and source EU funding through the Scottish European Green Energy Centre (SEGEC). • Identify at least one exemplar project, potentially through the Scottish Sustainable Communities Initiative, to explore cost effective provision of heat from renewable technologies.

Bioenergy Focus for Action to 2020

Top Level
• Maximise available biomass resources to support the expanding bioenergy sector. • Provide good quality information and advice that promotes the benefits of bioenergy to encourage end users to adopt the technology. • Encourage next generation bioenergy, including marine biomass and advanced conversion technologies. Fully exploit the opportunities available from waste to energy compatible with Government policy on waste prevention and recycling.
Supporting Development
• Maintain progress against the actions identified in the Wood Fuel Task Force report. This includes working with industry to support the development of long-term contracts and greater transparency in the market. • Continue to improve woodfuel supply forecasts including private sector supply and woody waste figures, taking into account existing markets for wood. • Continue with the cross government bioenergy group to ensure policies are joined up. • Ensure that the essential capacity building for bioenergy is included in proposals for skills development.

• Promote opportunities in the Energy from Waste sector, such as, encourage small, local district heating schemes, encourage AD of source segregated wastes, encourage partnership working across public and private sector, and explore opportunities in commercial and industrial waste. • Continue to develop anaerobic digestion through the Waste and Resources Action Programme 2009 and 2011.
Support Investment
• Continue to run the Scottish Biomass Heat Scheme until 2011. A total of £3.3 million of capital grants is available for heat-only business installation. Support ongoing development of the biomass supply chain and renewable heat installations under the Scottish Rural Development Programme. • Undertake evaluation of the Scottish Biomass Support Scheme in 2009 to help inform future support. • Continue to encourage the next generation of bioenergy, including marine biomass. • Continue to liaise with DECC to ensure Scottish bioenergy interests are met in the forthcoming Renewable Heat Incentive.
Guidance
• Promote best practice in the use of biomass and air quality. • A new National Waste Management Plan is currently being drafted. • FCS will provide support and advice through the Regional Biomass Advice Network (RBAN), an Energy Forestry Handbook and associated Best Practice Guidance and case studies to be published in 2009. FCS is also co-ordinating a marketing programme through RBAN. • Promote the Carbon Trust's guide to biomass heating "*Biomass heating: a practical guide for potential users."*
Planning
• The Scottish Government should continue ongoing engagement with Ofgem and the UK Government to discuss grid access.
Energy from Waste
• Quantify how much energy from waste (including AD) can contribute to renewable heat generation in Scotland. • Investigate heat recovery from a waste management plant. • Encourage operators of AD plants receiving public funding to make effective use of the heat by building in a contractual requirement to grant awards. • Enforce thermal treatment guidelines to ensure energy from waste plants treating any form of waste aim to capture the heat efficiently and seek markets for that heat. • Produce a new National Waste Management Plan. • Provide advice and support to key firms in Scotland currently seeking to create and use energy from waste. • Enable the creation and growth of CHP and/or heat networks in relation to energy from waste facilities with the aim of improving the competitiveness of business locations. • Enable the development of an impartial national resource to assist companies in priority sectors in developing and delivering solutions to derive

value from waste, including knowledge on heat demands.

FREDS Renewable Heat Group – Membership list

Name	Organisation
David Cameron	Scottish Renewables
Kathy Cameron	Convention of Scottish Local Authorities
Jon Cape	Renew Services Ltd
Rebecca Carr	Forestry Commission Scotland
Eric Dodd	Community Energy Scotland
John Ferguson	Binn Eco Park
Neil Ferguson	Scottish Enterprise
Samantha Fuller	Scottish and Southern Energy (Chair)
George Goudsmit	AES Solar
Ciaran Higgins	Glasgow City Council
Sue Kearns	Scottish Government (Co-secretary)
Jude Maxwell	Scottish Enterprise
Christine McKay	Scottish Government (Co-secretary)
Alistair McGlynn	Balcas
Bruce McGregor	Mitsubishi Electric Europe B.V.
Eric McRory	SEPA
Paul O'Brien	SDI
Maf Smith	Sustainable Development Commission
Bill Watson	Angus Biofuels

Acronyms Used and Glossary of Terms

Acronyms

ACT – Advanced Conversion Technologies

AD – Anaerobic Digestion

ASHP – Air Source Heat Pump

AQMA – Air Quality Management Area

BGS – British Geological Survey

CARES – Community and Renewable Energy Scheme

CEEF – Central Energy Efficiency Fund

CHP – Combined Heat and Power

COSLA – The Convention of Scottish Local Authorities

CPD – Continuing Professional Development

CUSP – Clyde Urban Superproject

DECC – The Department of Energy and Climate Change

DH – District Heating

ESCo – Energy Service Company

EfW – Energy from Waste

FCS – Forestry Commission Scotland

FREDS – Forum for Renewable Energy Development Scotland

GSHP – Ground Source Heat Pump

HA – Housing Association Housing

HAG – Housing Association Grants

HIE – Highlands and Islands Enterprise

ICE – Institute of Civil Engineers

LA – Local Authority

Ofgem – Office of Gas and Electricity Markets

RBAN – Scottish Regional Biomass Advice Network

RESG – Renewable Energy Skills Group

RHI – Renewable Heat Incentive

RIAS – Royal Incorporation of Architects in Scotland

ROC – Renewables Obligation Certificate

RSA – Regional Selective Assistance

RSPB – Royal Society for the Protection of Birds

SBHS – Scottish Biomass Heat Scheme

SCHRI – Scottish Community and Householder Renewables Initiative

SDC – Sustainable Development Commission

SDI – Scottish Development International

SEA – Strategic Environmental Assessment

SEDA – Scottish Ecological Design Association

SEGEC – Scottish and European Green Energy Centre

SEnt – Scottish Enterprise

SEPA – Scottish Environment Protection Agency

SG – Scottish Government

SME – Small to Medium Sized Enterprise

SPP6 – Scottish Planning Policy 6 – Renewable Energy Developments

SRDP – Scottish Rural Development Programme

TFEC – Total Final Energy Consumption

WRAP – Waste and Resources Action Plan

WSHP – Water Source Heat Pump

Glossary of Terms

Advanced conversion technologies
Gasification, pyrolysis or anaerobic digestion, or any combination thereof

Anaerobic digestion
A process in which micro organisms break down biodegradable material in the absence of oxygen.

Biodegrade
The attack or decomposition of materials by natural, living organisms such as bacteria, fungi, plants and animals.

Bioenergy
Energy for heat, electricity and transport generated from renewable biomass.
Biogas Biogas typically refers to a gas produced by the biological breakdown of organic matter in the absence of oxygen. Biogas is comprised primarily of methane and carbon dioxide.

Biomass
Organic matter used as a fuel, typically in the generation of heat or electricity. The definition does not extend to long-dead organic matter (specifically, fossil sources such as coal or oil).

Biomass boilers
Water heating systems fuelled by biomass.

Carbon neutral
A system or process may be considered carbon neutral if the net carbon released is balanced by the carbon absorbed, offset or sequestered.

Central heating programme
Provides central heating, insulation and advice. It is available to all households in the private sector who lack central heating and where the householder or partner is aged 60 or over.

Combined Heat and Power
Simultaneous generation of usable heat and power (usually electricity) in a single process. CHP is a highly efficient way to use both fossil and renewable fuels and can therefore make a significant contribution to the UK's sustainable energy goals, bringing environmental, economic, social and energy security benefits.

District heating
A system for distributing heat generated in a centralized location for residential and commercial heating requirements such as space heating and water heating. District heating plants can use a wide range of heat sources or fuels and provide higher efficiencies and better pollution control than localised boilers.

Fuel poverty
A person is living in fuel poverty if they spend more than 10 per cent of their household income on all household fuel use.

Gasification
A process that converts organic matter into carbon monoxide and hydrogen by reacting the raw material at high temperatures with a controlled amount of oxygen. The resulting gas mixture is called synthesis gas or syngas and is itself a fuel.

Geothermal
Relating to or produced by the internal heat of the earth

Greenhouse gas
A gas which contributes to the greenhouse effect when released into the atmosphere.

Heat map

A graphical representation of heat use data where the values in a two-dimensional map are represented as colours.

Housing association
A not-for-profit organisation that rents houses and flats in city centres, housing estates and the country. They aim to provide good, low cost accommodation for people who really need it.

Hydro-electricity
Electricity generated wholly or partially from the energy of water flowing through rivers or dams.

Landfill gas
Landfill gas is produced by organic waste decomposing under anaerobic conditions in a landfill site.

Low and zero carbon technologies
Development-wide, on site, or building integrated technologies that use renewable sources or fossil fuels (low CO2 emissions), or use only renewable sources (zero CO2 emissions)

Methane
A hydrocarbon gas produced by the biodegradation of organic matter.

Microgeneration
the generation of heat or electricity on a small scale, principally for local consumption in buildings

Off-mains
Not connected to the national grid for gas or electricity (or both).

Pyrolysis
The chemical decomposition of organic materials by heating. Pyrolysis differs from gasification in that it is carried out in the absence of oxygen or any other reagents, except possibly steam.

Renewable
Renewable energy forms are essentially inexhaustible, or are naturally replenished, unlike fossil fuel sources, which are finite and non-sustainable.

Retrofitting
Replacing an older heating system with a new one.

Soft loans
Low or zero interest loans.

Sustainable

(Of industry, development, or agriculture) avoiding depletion of natural resources; meeting the needs of the present without compromising the ability of future generations to meet their needs.

Waste biomass
That fraction of waste (municipal, commercial and industrial) that is similar to other sources of biomass or is of itself by its biological nature appropriate and suitable for energy recovery.

Wind-to-heat
Using devices to turn wind energy to heat, e.g. via mechanical forces and friction or feeding electricity generation straight into a heating system with storage.

Energy Units

Quantity	Name	Symbol
1,000,000,000,000 W	terawatt	T
1,000,000,000 W	gigawatt	G
1,000,000 W	megawatt	M
1,000 W	kilowatt	k

A suffix ‘h’ indicates hours. For example, 5kWh means five kilowatt hours of thermal energy (heat).

References

Climate Change (Scotland) Act (Scottish Parliament 2009)
http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact

Climate Change Delivery Plan: Meeting Scotland's Statutory Climate Change Targets (Scottish Government 2009)
http://www.scotland.gov.uk/Publications/2009/06/18103720/0

Community and Renewable Energy Scheme (CARES)
http://www.communityenergyscotland.org.uk/cares.asp

Conserve and Save: Consultation on the Energy Efficiency Action Plan for Scotland
http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ActionPlan

EU 20% Renewables Target
http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/07/13

Low Carbon Building Standards Strategy for Scotland
http://www.sbsa.gov.uk/sullivanreport.htm

New Air Quality Standards published in July 2007
http://www.opsi.gov.uk/legislation/scotland/ssi2007/ssi_20070182_en_1

Power in numbers: the benefits and potential of distributed energy generation at the small community scale in Scotland
http://www.theenergysavingtrust.com/corporate/Corporate-and-media-site/About-us/Our-public-policy-work/Renewables-and-distributed-energy

Renewables Obligation (Scotland) Order
http://www.opsi.gov.uk/legislation/scotland/ssi2009/draft/sdsi_9780111003268_en_1

Scotland's Renewable Heat Strategy: Recommendations to Scottish Ministers
http://www.scotland.gov.uk/Publications/2008/03/11102501/0

Scotland's Renewables Action Plan (Scottish Government 2009)
http://www.scotland.gov.uk/Resource/Doc/278424/0083663.pdf

Scotland's Renewables Action Plan: Strategic Environmental Assessment
http://www.scotland.gov.uk/Publications/2009/07/01093638

Scottish Building Standards
http://www.sbsa.gov.uk/

Scottish Planning Policy 6
http://www.scotland.gov.uk/Publications/2007/03/22084213/0

UK Low Carbon Transition Plan; UK Renewable Energy Strategy; UK Low Carbon Industrial Strategy (UK Government 2009)
http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

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