A Sustainable Future
The Welsh Red Meat Roadmap

www.hccmpw.org.uk
Over many generations, the work of traditional Welsh farming families has helped create spectacular landscapes that provide important habitats for the natural life of Wales. In recent years, our farmers have further responded to encouragement to develop a sustainable industry. This document recognises and seeks to advance that work. It offers stakeholders across the supply chain information on greenhouse gases and climate change and presents detailed, practical ways to improve performance, achieve the new and agreed goals, while adhering to the business model essentials of improving efficiency and profitability.

You’re not alone in this process; other colleagues, partner organisations and, of course, Hybu Cig Cymru’s staff, are here to help you. For more useful information check our website, www.hccmpw.org.uk.

Dai Davies
HCC Chairman
Contents

Executive summary ........................................................................................................... 5

The Journey To Date
Introduction; rationale for the roadmap, monitoring and review, communication ........ 7
The rolling environmental legacy of livestock farmers ......................................................... 8
Structure and size of the Welsh red meat sector ............................................................... 9
Complementary existing policies and strategies in Wales ............................................. 12

The Drivers
Targets for reducing greenhouse gas emissions ............................................................... 15
Assessing environmental impacts ................................................................................. 18
Greenhouse gases and the Welsh livestock industry ..................................................... 18
Measuring greenhouse gas emissions ............................................................................. 18
Research to establish the carbon footprint of Welsh red meat production .................. 18
Declining availability of resources and the potential impact on Welsh agriculture ...... 19
Water quality and usage ................................................................................................. 21
Carbon conservation and sequestration ........................................................................ 21
Sustainable land management ....................................................................................... 23
Agri – environment schemes ......................................................................................... 23
Renewable energy .......................................................................................................... 24

The Road Ahead: Opportunities for improving sustainability
a. Farms ......................................................................................................................... 27
   • Manipulation of ruminant diets ............................................................................. 27
   • Genetic improvement ......................................................................................... 27
   • Animal health and welfare ............................................................................... 29
   • Grassland/forage management ......................................................................... 29

b. The Meat Processing Sector
   • Integration and innovation ................................................................................. 31
   • Water and processing ....................................................................................... 31
   • Energy ............................................................................................................... 32
   • Controlling Waste ............................................................................................ 32

c. The Retail Sector
   • Integration, innovation and bringing environmental evolution to retail enterprises ................................................................. 33

Appendix
Strategic context – in detail: additional and existing associated policies and support strategies in Wales ................................................................. 37
Executive Summary

Industry Strengths
It is because of the custodial efforts of livestock farmers that Wales has such a diverse rural environment that is rich in wildlife, is visitor-friendly and offers a network of protected areas that is carefully managed by responsible grazing.

The total value of the sector to the Welsh economy, taking into account the agricultural, processing and retail sectors, is estimated to be more than £1 billion per annum.

Welsh livestock farmers also underpin the visitor economy, which supports 172,000 jobs and contributes £6.2 bn in Gross Domestic Product.

Stakeholders in all sectors of the agricultural and processing community have positively adapted to the demands for the new, sustainable way of life and are already playing a prominent and proactive part in the safeguarding of the environment.

There are a host of useful and informative advisory targets that appear in the policy documents of industry support sources that seek to empower producers, processors and retailers to manage valuable resources in a more sustainable manner.

Responding To The Challenge
Hybu Cig Cymru - Meat Promotion Wales committed, on behalf of the industry, to coordinate an environmental roadmap for Welsh red meat production within the Strategic Action Plan for the Welsh red meat industry which was launched in April 2009.

This roadmap seeks to set out how livestock farmers, processors and retailers in Wales can achieve new and agreed goals while adhering to the business model essentials of improving profitability and sustainability.

The roadmap considers challenges such as the industry’s approach to greenhouse gasses, carbon footprint, water quality and use, biodiversity, countryside management and carbon conservation and sequestration and their solutions.

The roadmap cautions additional drivers are likely to impact on environmental policies including disease threats (e.g. bovine TB); the ageing farming population; land prices and the CAP Reform review.

Research suggests that agricultural operations currently contribute towards Wales’ total greenhouse gas emissions although it is very difficult to accurately quantify as measuring greenhouse gas emissions at farm level is far from an exact science.

Carbon footprinting tools are available and will be highly valuable for assessing emissions on the farm but they are not able to take into account certain variations.

Positive Impacts and Actions
Immediate opportunities for improving sustainability on farm include clever manipulation of ruminant diets, genetic improvement of livestock, breeding for the marketplace, grassland and forage management and control of waste.

Immediate opportunities for improving sustainability in the retail sector include the further development of the positive sustainability policies of both independent butchers and supermarket chains. Independent butchers can encourage further local sourcing transparency, bringing best practice and fewer food miles to the High Street. Supermarkets can extend a raft of signature strategies to provide consumer value and quality and reduce the carbon footprint of food, ensure its sustainability and convey these actions to customers.

Immediate opportunities for improving sustainability in the meat processing sector include increased efficiencies in the management of waste, namely, by-products and packaging, and becoming smarter with energy use.

It is simplistic to believe that falling livestock numbers in Wales could in any way be a positive for reducing climate change impacts. Increasing demand for quality red meat products, particularly from emerging countries, will be met by displaced, and possibly less sustainable, production while having an extremely adverse effect on the economy of Wales.

The upland soils of Wales are recognised as being important carbon sinks and their continued management in a sensitive manner by farmers, combining biodiversity and production outputs, is essential to conserving and increasing carbon stocks.

Welsh farmers will need to positively further respond to the challenges and opportunities offered by the declining availability of valuable resources, such as water, oil and phosphorus. On-farm, renewable energies are becoming increasingly attractive.

Reducing the levels of food wasted in the home is an area that needs further consumer encouragement and retailers and other industry organisations can contribute towards educating and informing consumers.

HCC is collecting and analysing data to calculate farm carbon footprints to provide farmers with the most accurate tools available to offer accurate benchmarking, a snapshot assessment of greenhouse gas emissions and provide a set of reliable standards for sustainability.

HCC pledges to practically support and encourage all producers whenever it can in this process and offers this Roadmap as an outline of the opportunities for assistance to achieving these targets that are available to farmers in Wales.
The Journey To Date

Introduction

Climates change in more than one sense. It is not that long ago that most people associated ozone almost exclusively with a trip to the seaside and assumed a greenhouse gas was a pink paraffin vapour. Nowadays, we all know these terms have far more serious overtones. We have amended our whole outlook on life in a relatively short time. Recycling has become a weekly formality; consumers frown upon unnecessary packaging and the need to use energy wisely is recognised by all. There is a widespread awareness of environmental matters, an acceptance of climate change and we all appreciate the need to play a responsible part in environmental sustainability.

The red meat industry is no different. Stakeholders in all sectors of the agricultural and processing community have quickly adapted to the new, sustainable way of life and are already playing a prominent and proactive part in the safeguarding of the environment. To demonstrate this positive role already enacted by the Welsh red meat industry, and to assist in the collaborative formulation of subsequent strategies to further encourage and sustain change, HCC committed to coordinate an environmental roadmap for Welsh red meat production within the Strategic Action Plan for the Welsh red meat industry which was launched in April 2009.

This document - A Sustainable Future: The Welsh Red Meat Roadmap - aims to set out how livestock farmers and processors in Wales can achieve new and agreed goals while at the same time adhering to the business model essentials of improving their profitability and sustainability. The roadmap focuses on beef and sheep meat production in Wales. It offers a practical way forward, a guide to change for farmers, processors and retailers. Pig meat production will not be considered in this roadmap.

The UK has a legally binding target under the Kyoto Protocol to reduce greenhouse gas emissions to 12.5% below 1990 levels by 2012. To play its part in ensuring that Welsh farming meets this target, beef and sheep production needs to reduce its annual GHG emissions by at least 8% by 2020 (with the 2009/10 financial year being the baseline). However, we are all aware that we live in harsh economic times. It is crucial that as the industry works towards contributing to a reduction of greenhouse gases, it does not take its eye off the ball and ignore what must remain the overarching aim - to maintain the drive for commercial efficiency and sustain and develop a vibrant and healthy livestock sector that continues to produce high quality meat that is renowned and respected the whole world over.

Hybu Cig Cymru is confident that, by adopting the strategies laid out in this roadmap, the twin targets of both addressing the challenges posed by climate change and maintaining momentum towards commercial efficiency can be achieved. That farmers, with direction and support, can be relied upon to deliver the evolutionary changes on farm needed to benefit the environment of Wales. For the industry as a whole, as we implement key behavioural changes and attempt to build a better, holistic way of working, the effective monitoring, accurate evaluation and clear communication of the actions we undertake will become a vital part of the ongoing process in the years to come. They will be important tools to achieving lasting impacts and will help the industry to demonstrate where solid improvements have been made and also identify where inappropriate remedies are failing short.

Hybu Cig Cymru will draw together this information. An initial review will take place in two years, followed by an interim review in 2016 and a final and comprehensive review in 2020, to assess the longer term gains of the strategies outlined and the lessons that can
be learned to take on the issues addressed. In between, members of HCC’s Industry Development team will ensure producers and processors are kept abreast of new technologies and the latest information at meetings, farm open days and shows. HCC’s communication department will detail the developments and promote the progress made by industry participants towards achieving the programme’s targets. Media briefings, press releases, technical articles in the farming press, and, online, via the HCC website, will be just some of the information outlets that farmers and processors can turn to when seeking advice.

Good practices and new ideas, alongside those that have proved ineffective, will be communicated to stakeholders to ensure that, as we move forward, the best practices are understood and imparted clearly and concisely.

HCC pledges to practically support and encourage all producers whenever it can in this process and offers this roadmap as an outline of the opportunities for assistance to achieving these targets that are available to farmers in Wales.

The rolling environmental legacy of livestock farmers
Wales is a land of beautiful, rolling landscapes and lush greenery with many examples of remote, elemental scenery that may appear to be constructed as a wonderful accident of nature. In much of Wales, that is simply not so. Welsh farming systems, over many generations, have contributed towards the existence of many of the important habitats and species present in Wales and have helped develop the continually evolving landscape and culture that is richly valued by residents and greatly enjoyed by visitors.

In the main, it is because of livestock farmers that Wales has a rural environment rich in wildlife, a network of protected areas being carefully managed by responsible grazing, biodiversity, carbon sequestration and production gains. This tended farmland provides protected living areas that support habitats and enables connectivity opportunities for innumerable species.

Addressing climate change is not just about reducing greenhouse gas emissions. This roadmap considers other issues, such as water quality and use, biodiversity and countryside management. Agriculture plays a strong part in carbon conservation and sequestration. Apart from reducing greenhouse gas emissions, the entire red meat supply chain is positioned to improve on areas such as:

- Reducing water and energy usage through targeted audits and planning;
- Preventing water and air pollution by addressing areas where potential incidents may arise;
- Enhancing biodiversity through maintenance and improvements to habitats and reducing impacts on these habitats;
- Enhancing the Welsh countryside and limiting negative impacts to important ecological and aesthetic areas.

Farmers are not alone in adapting to the changes needed. Organisations within the natural environment land management sector can deliver production and cost benefits, as well as biodiversity and environmental gains, by working in partnership with producers. For example;

- A grant scheme from the Wales Biodiversity Partnership to enhance sites for priority species and habitats by the installation of infrastructure to allow a priority habitat on a farm to be appropriately grazed;
- The Countryside Council for Wales offer Section 15 Agreements targeted towards SSSI’s, which are developed in partnership with a landowner or grazer to deliver a best practice management regime for five years. Funding can contribute towards the cost of infrastructure and ongoing management;
- Funding from sources such as landfill tax and the charitable sector can be used to enable partnerships to be made between farmers and the natural environment management sector, to deliver regional or landscape scale projects covering multiple sites or large contiguous areas.

2 Such projects can support farmers to deliver grazing on habitats of principle importance (Section 42 Habitats), via land management and infrastructural improvements, delivering outcomes for Section 42 Habitats and Species, and providing marketing opportunities for produce from the livestock that are delivering these gains.
Additional drivers that are likely to impact on environmental policies include: disease threats (e.g. bovine TB); the ageing farming population; land prices and the CAP Reform review. From a global perspective, issues such as a rising global population, World Trade Organisation negotiations, global demand changes for Welsh lamb and beef and future agreements on climate change such as the Kyoto Protocol will all need to be taken into account. These factors fall beyond the scope of this roadmap, which will focus on practical and workable strategies that can be successfully introduced and implemented within the supply chain.

**Structure and size of the red meat industry in Wales**

The geography, the landscape and the climatic conditions of Wales strongly favour the raising of cattle and sheep and the Welsh red meat sector is a very important contributor to the Welsh economy and to the sustainable care and management of the Welsh countryside. In 2009, Welsh finished cattle, sheep and lamb production contributed 39% of the annual total value of Welsh agricultural output, worth £425 million. The total value of the sector to the Welsh economy, taking into account the agricultural, processing and retail sectors, has been estimated to be more than £1 billion a year.

Farmers also create an unique environment for both locals and visitors to enjoy. Welsh livestock farmers underpin the visitor economy, which supports 172,000 jobs and contributes £6.2bn in GDP.

**Livestock numbers:** In June 2010, there were 4.1 million breeding ewes in Wales, 242,000 female beef cows and 274,000 female dairy cows over 2 years old. Both the Welsh sheep flock and Welsh beef herd have seen a reduction in numbers since the Common Agricultural Policy (CAP) reforms in 2003 when, for the first time, payments were ‘decoupled’ from production. As Figures 1 and 2 highlight, there has been a 17% decrease in breeding ewe numbers in Wales during the six years between 2004 and 2010. During the same period beef cow numbers fell by 8%.

**Figure 1:** Breeding ewe numbers in Wales (2004 - 2010)

Source: Welsh Assembly Government
The number, and the average size, of flocks and herds in Wales have also decreased. In June 2004 there were 15,483 sheep and lamb holdings in Wales, with an average flock size of 629 head. By June 2010, these figures had decreased to 14,398 holdings with an average flock of 573.

The average size of the beef herd (females aged two years or more) in Wales has remained relatively constant in recent years, with 24 and 25 beasts being the average in June 2004 and June 2010 respectively. There has, however, been a significant fall in the number of beef cow holdings during the same period with 9,542 holdings registered in 2010, compared with 10,816 holdings in 2004. This suggests that, rather than decreasing the number in their herds, some beef farmers in Wales in the period concerned have decided to exit the sector. The dairy sector has seen a similar pattern. The average size of the dairy herd (females aged two years or more) in Wales increased from 66 in 2004 to 78 in 2010, although the number of dairy cow holdings decreased during the same time from 4,564 to 3,536. Approximately 50% of Welsh beef production arises from the dairy sector and such a decline, should it continue, will create concerns about the industry’s ability to meet demand for Welsh beef. The production of beef from the dairy industry is very efficient with regard to greenhouse gas emissions and production of beef animals from dairy cows, which need to produce a calf per year, reduces the number of beef cows that need to be maintained.

In Wales, an estimated 80% of organic holdings have beef and/or sheep enterprises with around 15,000 breeding cattle and 240,000 breeding ewes accounting for circa 6% of Welsh breeding stock. While 70% of Welsh organic finished cattle were marketed as organic in 2010,
only 36% of lambs were marketed as organic, in part as a consequence of the high prices being achieved for non-organic lambs. In 2010, organic farming in Wales (fully organic and in-conversion) grew to 124,000 ha (8.5% of Welsh agricultural land use) on over 1,000 holdings. Some 104,000 ha (84% of organic land) was permanent grassland or rough grazing, with 7,500 ha down to arable/horticultural crops and 10,000 ha as temporary grass.

Longer term, the Welsh livestock industry is well positioned. Consistent production quality and incremental marketing and promotional impacts have produced strengthened annual demand for products in the UK, European and worldwide markets. Against this background, we must further interlink sustainable development with commercial stability and interweave corporate strategies to mitigate climate change.

It would be highly simplistic to believe that falling livestock numbers in Wales could in any way be a positive for reducing climate change impacts. Should numbers in the Welsh livestock industry continue to decline, the increasing demand for quality red meat products, particularly from emerging countries such as China, will need to be met either from other parts of the UK - requiring land use changes in those areas and only shifting the problem rather than solving it - or from other parts of the world. Such changes would have an extremely adverse impact on the economy of Wales, however, while by no means ensuring that global sustainability is improved.

Over the last decade producers have been progressively increasing their lamb carcass weights. In 2004, the average carcass weight for a lamb at Welsh abattoirs was 17.8kg; in 2010, the figure stood at 18.2kg. This increase in carcass weight, coupled with an increasing lamb rearing percentage within the Welsh flock, has ensured that production levels in Wales have not decreased at the same rate as sheep numbers.

The increase in carcass weight and rearing percentages can be linked to better breeding and more efficient feeding and flock management, improving business performances as well as reducing greenhouse gas emissions on Welsh farms.

In fact, overall sustainability benefits more from ensuring that areas that are ideally suited to livestock production, and which have limited opportunities for other forms of agricultural production (such as the upland areas of Wales), continue to remain strongholds of livestock production.

Wales has many such habitats that offer limited opportunities for commercial utilisation other than livestock production.6

Area Classifications
The majority of Welsh red meat holdings are based in land technically classified as Less Favoured Areas (LFA); approximately 80% of the 1.6 million hectares of agricultural land in Wales falls within these designated LFAs.

Within this, 56% are inside a Severely Disadvantaged Area (SDA) and 23% are classified Disadvantaged (DA). In 2010, there were 10,897 cattle and sheep holdings in areas defined as LFAs compared to 2,036 holdings in lowland areas. The majority of sheep and beef cattle are in the upland and hill areas of Wales. Powys, which is predominantly SDA, had 38.5 percent of the breeding ewes in Wales and 28.4 of the Welsh beef breeding herd in 2009.

The North West of Wales, which includes Snowdonia, had 16.1 and 16.8% of the breeding ewes and beef breeding herd respectively. The regions with the highest percentage of the dairy breeding herd in 2009, were Carmarthenshire and Pembrokeshire with 25.3 and 23.5% respectively.

Complementing and enhancing existing policies and strategies in Wales
In the production of this roadmap, HCC has sought to ensure it provides a valuable and, most importantly, additional tool and strive to avoid conflict with or overlap with any other positive strategies that are already in place to aid farmers. A reference list of complementary and current strategic measures can be found in an appendix attached to this report.
In the eight years of its service to the industry, Hybu Cig Cymru has established a proven track record in providing information, funded through the Rural Development Plan for Wales 2007 – 2013 (RDP), Farming Connect (FC) or levy, on a wide variety of relevant issues to benefit farmers. Here is a brief synopsis of key HCC Actions To Date:

- **Research and Development (R&D)** HCC provides funding to, or funds collaboratively with other organisations, a R&D project bank to encourage new technologies on farm that will assist increased productivity and sustainability. HCC, jointly with EBLEX and QMS, also supports a number of studentships to encourage new scientists into the industry.

- **Rural Development Plan 2007-13 (RDP) funded activities**: HCC develops and implements for RDP a programme of farm events, farmer meetings, projects, publications and on-line information to demonstrate new technologies and assist farmers in applying new strategies. Group study tours are available to farmers to visit other parts of the UK and Europe to observe, develop and apply innovation ideas to existing management practices. The HCC Livestock Scholarship enables travel to a country of choice to learn about systems and technologies for application in home businesses. Full details of these funded projects, and all projects relevant to climate change issues, are available from HCC.

- **Farming Connect (FC)** HCC has been involved in the delivery of the Red Meat Development Programme (RMDP) on behalf of Farming Connect, including coordinating 12 demonstration farms and 20 discussion groups across Wales that form a national hub that drives the dissemination of up to date information to Welsh sheep and beef farmers. It is anticipated that Farming Connect will continue to be an important vehicle for the delivery of key elements within this roadmap.

Full details of the raft of projects within this brief are available on request.
The Drivers

Targets
There are a host of useful and informative advisory targets that appear in the policy documents of industry support sources that seek to empower producers, processors and retailers to manage valuable resources in a more sustainable manner:

The Climate Change Act (2008) provides a legal framework for ensuring that Government meets its commitments to tackle climate change. The Committee on Climate Change (CCC) was set up as an independent body as part of the Act and will monitor and report back to Parliament annually on progress made by the Government in meeting carbon budgets.

The Act requires that emissions are reduced by at least 80% by 2050, compared to 1990 levels. The 2050 target was raised to 80% from 60% following recommendations set out by the CCC.

Greenhouse Gases: The member countries of the Framework Convention on Climate Change negotiated an international agreement and adopted the Kyoto Protocol unanimously in 1997. The Kyoto Protocol sets mandatory targets on greenhouse gas emissions for many of the world’s leading economies, ranging from -8% to +10% of the countries’ individual 1990 emissions levels. Commitments under the Protocol vary from nation to nation with an overall 5% target for developed countries to be met through cuts (from 1990 levels) of 8% in the EU.

Wales: The overall target for reducing greenhouse gas emissions in Wales is set out in the Climate Change Strategy for Wales (October 2010). In the previous (prior to May 2011) Welsh Government’s One Wales policy document, there was a continuing commitment to 3% annual reductions in areas of devolved competence (which includes agriculture and land use), against a baseline of average emissions from 2006-10.

In addition, Wales is also committed to achieving at least a 40% reduction in all emissions in Wales by 2020 against a 1990 baseline. Ranges for sectoral reductions have also been set; for agriculture and land use, the target by 2020 is a reduction to at least 4.97 Million Tonnes of CO₂ equivalent (MtCO₂e) but the more ambitious aim is to reach 4.07 MtCO₂e by 2020 against a baseline of 5.57 MtCO₂e. Ranges have been adopted to provide challenging targets, while at the same time retaining flexibility for each sector to identify and adopt new measures.

Waste: Towards Zero Waste is the overarching waste strategy for Wales, from now to 2050 across all sectors. Targets will be consulted on in 2011 but intentions for the Manufacturing, Service and Retail sector, which are of most relevance to the red meat industry, are as follows:

- The total quantity of commercial waste produced in Wales will reduce by 1.2% of the 2006-07 numbers every year to 2049-50;
- The total quantity of industrial waste produced in Wales will reduce by 1.4% of the 2006-07 numbers every year to 2049-50.

More specifically for the food industry, it is proposed that this plan will include the following ambition:

- The total quantity of food and associated packaging waste
produced by the food manufacturing, service and retail sectors will reduce by an amount equivalent to 1.2% of the 2006-07 numbers every year to 2049-50.

In addition, the following targets (shown below) for commercial, industrial and municipal waste were consulted on in the production of Towards Zero Waste.

Environment strategy: Farmers should be aware that the Welsh Assembly Government, via the Environment Strategy for Wales, provides the strategic direction for water policy, biodiversity policy and environmental sustainability in Wales, framed within a complex set of regulatory and operational responsibilities. The current key outcomes for the Welsh Government’s water policy are set out in the Sustainable Development Scheme - One Wales: One Planet - and the Environment Strategy for Wales.

The key outcomes for biodiversity policy and environmental sustainability are set out in the same documents, plus ‘Wales A Better Country’ and ‘Starting to Live Differently: The Sustainable Development Scheme’.

Air: Farmers accept efforts to limit noise, dust and odour pollution wherever possible and the National Emissions Ceiling Directive requires Member States (including Wales) to limit and reduce emissions of sulphur dioxide (SOx), nitrogen dioxide (NOx), volatile organic compounds (VOCs) and ammonia with ammonia production being the most relevant to the red meat industry.

The Air Quality Strategy for England, Wales, Scotland and Northern Ireland was published in 2007. There have been steady reductions in sulphur and nitrogen oxides recorded and it is likely scrutiny will turn more towards the impact of ammonia, which the 2007 Air Quality Strategy does not currently take into account. The diffuse sources of ammonia emissions makes analysis of control measures and policies challenging and an additional complexity is the potential for interaction between losses of nitrogen compounds to air and water, so called “pollution swapping”, where, for example, techniques to reduce ammonia emissions from the soil to air could potentially lead to some nitrogen emerging as nitrates in water courses.

However, HCC is conscious that producers and processors must ensure they expend primary efforts towards keeping their businesses profitable and efficient and that attempts to address all of these

<table>
<thead>
<tr>
<th>waste type</th>
<th>Baseline 2007</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2015/16</td>
<td>2019/20</td>
</tr>
<tr>
<td>Commercial waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 recycled (per cent)</td>
<td>35</td>
<td>57</td>
</tr>
<tr>
<td>Industrial waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 recycled (per cent)</td>
<td>40</td>
<td>63</td>
</tr>
<tr>
<td>Municipal waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>recycled (per cent)</td>
<td>25</td>
<td>58</td>
</tr>
</tbody>
</table>


8 | Commercial waste includes waste from offices, showrooms, hotels and premises occupied by government and local authority. A full definition can be found at www.legislation.gov.uk/uksi/1992/588/schedule/4/made

9 | Industrial waste includes waste from heavy industries, scientific research, dredging and excavations. A full definition can be found at www.legislation.gov.uk/uksi/1992/588/schedule/3/made
The following are the Strategy’s aspirational goals for Biodiversity and Water: An environment which is clean, healthy, biologically diverse and valued by the people of Wales. Environmental considerations are integrated in all policies, programmes and service delivery and that high quality and consistent environmental evidence is available to inform the decision making process. The roles and responsibilities of all organisations are understood leading to better integration for the delivery of environmental protection and enhancement. Appropriate education about our environmental impacts is in place and good quality information is available at the point where people make decisions. Soil is managed to safeguard its ability to support plants and animals, store carbon and provide other important ecosystem services. The loss of biodiversity has been halted and a definite recovery can be seen in the number, range and genetic diversity of species, including those that need very specific conditions to survive. The wider environment is more favourable to biodiversity through appropriate management, reduced habitat fragmentation and increased extent and interconnectivity of habitats. Sites of international, Welsh and local importance are in a favourable condition to support the species and habitats for which they have been identified. The quality and diversity of the natural and historic character of our landscape and seascape is maintained and enhanced. Water resources are managed sustainably meeting the needs of society without causing damage to the environment; Water is used more efficiently across all sectors. The high quality of our drinking water is maintained. The quality of our groundwater, rivers, lakes and coastal waters is maintained and enhanced. Diffuse pollution is better understood and action is being taken to reduce and manage diffuse pollution.
helpful sustainability targets nevertheless offers a real challenge to time and resources. That’s why HCC will aim to provide a convenient, manageable and accessible supply chain support system for sustainability planning that will enable maximum interventions with minimal disruption to commercial concerns.

Assessing Environmental Impacts

Greenhouse gases and the Welsh livestock industry
Carbon dioxide emissions are a relatively minor component in livestock production (approximately 10%) and arise from the use of conventional electricity and fossil fuels. Methane emissions, from rumen metabolism and manure handling activities, and nitrous oxide, which comes primarily from soils to which fertiliser and manures are applied, with manure and slurry handling, contribute the remainder of the total greenhouse gas emissions from agriculture in Wales.

There is broad scientific agreement that emissions should be measured in carbon dioxide equivalents. The carbon dioxide equivalent calculation takes into account that methane and nitrous oxide have 100 year Global Warming Potentials (GWP100) that are 21 and 300 times that of carbon dioxide respectively.

Measuring Greenhouse Gas Emissions
Measuring greenhouse gas emissions at farm level is far from an exact science. Evidence suggests that agricultural operations and land-use changes do contribute to Wales’ total greenhouse gas emissions through the release of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O).

Carbon footprinting tools are available for assessing emissions on the farm - but they are not able to take into account variations that may occur, for example, due to breed or the environmental conditions. National inventory calculations are used in these models, but traditionally these calculations have been formulated without taking into account differences that occur between different management systems. In an effort to provide a clearer picture, ongoing research is continuously updating the models in use. The Department for Environment, Food and Rural Affairs (DEFRA) is currently funding an extensive programme of research projects to make improvements to the national inventory which will make them more accurate, helpful and relevant to the red meat industry.

The UK Greenhouse Gas Inventory is developed and maintained by AEA (a global consultancy firm specialising in energy and climate change) under contract with DEFRA. The inventory is the means by which the UK’s progress towards achieving the targets, set by the United Nations Framework Convention on Climate Change (UNFCCC) in March 1994 and the Kyoto Protocol, are assessed. Parties to the UNFCCC are committed to develop, publish and regularly update national emissions inventories of greenhouse gases.

There are tools currently available for farmers or groups of farmers to undertake carbon footprint assessments. But HCC stresses that care must be taken with how the results are interpreted and cautions that if a group of farmers assess using different tool providers then they should not attempt comparisons. Individuals using the same methodologies to monitor progress and improvements can achieve consistent assessment and, in addition, the process will highlight the areas where improvements are needed, allowing a planned and considered approach to be made.

One of the most constructive methods for effective carbon footprinting is for a group of farmers to work together, make comparisons and benchmark against each other their standings. In time, the information obtained will gradually increase and allow review.

Research to establish the carbon footprint of Welsh red meat production
HCC has collected information from a representative range of Welsh farms and worked with Bangor University to establish baseline data and enable positive monitoring of the progress that Welsh farms are making towards achieving their sustainability targets.

12 The Land Use Climate Change Report (March 2010) suggests a figure of approximately 11%.
making to reduce their carbon footprint. This data is not meant to be a statistically valid sample but a robust representation of the variety of farm types that occur in Wales.

The data shows (shown below) there is considerable variation in the estimated footprint per hectare between the farms studied. The lowest footprint was 2,103 kg CO₂e/ha/yr while the highest footprint was 8,797 kg CO₂e/ha/yr. This variation was also seen with the outputs per unit product with the lowest footprint per kg of lamb being 7 kg CO₂e/kg, compared with the highest at 51 kg CO₂e/kg. The footprint per kg liveweight of beef was generally slightly higher than lamb but again considerable variation was seen. The lowest footprint for beef was 5 kg CO₂e/kg and the highest was 61 kg CO₂e/kg.

Factors including management systems, stocking rates and reliance on bought-in feeds have produced considerable variations. Recorded emissions of methane are dominated by enteric fermentation from livestock and they tend to vary according to type and numbers of stock. One of the major factors affecting the footprint of farms in Wales was found to be their soil type. For instance, it was found that, on some farms, up to 90% of their nitrous oxide came directly from the soil. Of course, this has major implications on how these farmers can reduce their footprint; while they may still take on board strategies such as genetic improvement and reducing their fertiliser inputs, there is very little they can do to adjust the impact of their soil type and they will remain high emitters of nitrous oxide.

HCC is already collecting and analysing data and will continue to work with designated farms at specific times in the future to calculate farm carbon footprints using whichever formulae are universally considered to be the most accurate at the time. HCC’s ambition is to provide farmers with the most accurate tools available to offer accurate benchmarking, a snapshot assessment of greenhouse gas emissions and provide a set of reliable standards for sustainability.

Declining availability of resources and the potential impact on Welsh agriculture

In the not-so-distant future, Welsh farmers will need to respond to the challenges and opportunities offered by the declining availability of valuable resources, such as oil and phosphorus. It will be essential for individual farmers to review their activities to see where savings and improved efficiencies can be made.

Oil: World demand for oil is likely to continue to rise for the foreseeable future with the rapid development of countries such as China, India and Brazil. The significant rise in oil prices over the past decade may signal the arrival of “Peak Oil” production and there is considerable informed opinion that suggests cheap oil may well now be a thing of the past. “Peak Oil” does not mean that there is no more oil left to extract, but rather it relates to how easy extraction is from the available sources.

Carbon footprints from Welsh farms, 2010

<table>
<thead>
<tr>
<th>Unit measured</th>
<th>Average</th>
<th>Lowest</th>
<th>Highest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep (kg CO₂e/kg lwt)</td>
<td>23</td>
<td>7</td>
<td>51</td>
</tr>
<tr>
<td>Beef (kg CO₂e/kg lwt)</td>
<td>25</td>
<td>5</td>
<td>61</td>
</tr>
<tr>
<td>Hectare (kg CO₂e/ha/yr)</td>
<td>4718</td>
<td>2103</td>
<td>8797</td>
</tr>
</tbody>
</table>
now seems inevitable that demand will consistently exceed supply probably resulting in significant increases in oil prices. Red meat producers in Wales, alongside colleagues in all sectors of agriculture, will be vulnerable to rises in oil prices. Increasing energy prices will also impact on the price of fertilisers and feedstuffs bought on to farms. Farmers can also investigate the advantages of alternative, renewable energies to reduce their reliance on traditional fossil fuels with the help of schemes such as Glastir Agricultural Carbon Reduction and Efficiency Scheme (ACRES). There are good examples across the industry where renewable energies are being successfully installed but, of course, care needs to be taken with the planning, cost and specific application as some of these technologies may incur high expense in certain applications.

**Phosphorus**

The gradual depletion of phosphorus resources may be less frequently reported than the depletion in oil reserves but nevertheless will have a major impact on Welsh agriculture. Grassland and forage crops rely on the application of fertilisers to maximise yields and these fertilisers contain phosphorus. Phosphorus is a non-renewable resource and agriculture is dependent on rock phosphate for its supply. The global peak in phosphorus production is expected to occur around 2030, but with quality already

**Peak Phosphorus Curve**

![Peak Phosphorus Curve](chart)

*After this point, production decreases, placing upward pressure on prices and increasing international tensions.*

A Sustainable Future - The Welsh Red Meat Roadmap


15 | Environment Agency (2009). Water for people and the environment

16 | Specifically, these include: Water Bodies used for the abstraction of drinking water; Areas Designated To Protect Economically Significant Aquatic Species (areas protected under Freshwater Fish Directive 79/658/EEC, Shellfish Directive 79/923/EEC); Recreational Waters (areas protected under Bathing Water Directives 76/160/EEC and 2006/71/EC); Nutrient Sensitive Areas (areas protected under Nitrates Directive 91/676/EEC, Urban Wastewater Treatment Directive 91/271/EEC); Areas Designated For The Protection Of Habitats Or Species where the maintenance or improvement of the status of water is an important factor in their protection (Natura 2000 sites under Birds Directive 79/406/EEC and Habitats Directive 92/43/EEC).

17 | The Environment Agency already undertakes work through the Welsh Catchment Initiative to provide advice and guidance to farmers and examples include: nutrient management planning to ensure nutrients are targeted; advice on applications of manures, slurries or inorganic fertilisers; helping farmers undertake land operations with consideration for the effects of soil erosion; advising farmers on using agricultural pesticides with care and due consideration on the selective occasions that they are used to avoid pollution and damage to the environment. Environment Agency Wales Welsh Catchment Sensitive Farming (funded by the Welsh Assembly Government) works in six priority catchments in Wales at Cain, Cleddau, Clwyd, Teifi, Usk and Wye, to prevent diffuse pollution.

decreasing and production costs increasing, it is likely that costs will rise substantially. Western Europe is totally dependent on imports of phosphorus, making the continent very vulnerable to export restrictions that have been imposed by some of the major phosphorus producing nations such as China in their bid to secure sufficient supplies for their own indigenous use.

Farmers can review, for example, the amount of chemical fertilisers required on their farms by undertaking a nutrient management plan formulated with the help of an expert through the Farming Connect Whole Farm Plan service and, along with soil sampling, this will help farmers to accurately target the use of this valuable and limited resource.

Organic systems do not rely on imported phosphorus but these systems will have their own challenges to ensure crop nutrient requirements are met. Research into the synthesis, or harvesting, of phosphorus more efficiently and are able to cope better with soils that have a low phosphorus status. Such new varieties will be a significant tool for farmers in the future to enable them to respond and adapt to the changing conditions.

Water: Water resources are under increasing pressure globally with demand rising due to climate change and population growth and have led to an assessment of the embedded water or water footprint of agricultural products. Food for Wales; Food from Wales states 'the embedded water in our goods and food services needs to be highlighted to understand how our consumption affects water scarce regions and how greater local sourcing will impact future water resources availability in Wales and beyond'.

The UK is the sixth largest net importer of water in the world, and only 38% of total water used comes from its rivers, lakes and groundwater reserves. The average Briton uses about 3,400 litres of water per person per day in food and drink consumed and in goods and services used.

Water quality and usage

The Water Framework Directive exists to manage the water environment. The Environment Agency has produced River Basin Management Plans (RBMP’s) which set out objectives for water bodies within each river basin and how they are to be achieved at each of the River Basin Districts (RBD) in Wales, the Western Wales and two cross-border river basin districts, the Dee and the Severn. The first RBMPs set the framework for protecting and enhancing the water environment from 2009 to 2015. Specific overarching objectives of the Plans are to:

- Prevent deterioration and enhance the condition (status) of aquatic ecosystems, including wetlands and groundwater;
- Promote sustainable water use;
- Reduce pollution; and
- Contribute to the mitigation of floods and droughts.

These waters are protected as they either have specific uses, such as for drinking water or for fisheries, or because they provide important habitats and are home to species that directly depend on water.

The battle against all pollution is at the heart of the Water Framework Directive. Diffuse pollution can arise from a range of rural and urban sources and farmers and landowners can avoid contributing to any pollution by efficient application of fertilisers and manures, which helps to prevent and reduce water pollution and has the added benefits of both reducing emissions of nitrous oxide and reducing costs.

Environment Agency Wales continues to work closely with farmers to ensure farming practices do not impact on water quality. Less than four% of Wales is designated a Nitrate Vulnerable Zone (NVZ), where farmers have to follow additional rules to minimise losses of nitrogen in particular.

Carbon conservation and sequestration

The upland soils of Wales are recognised as being important carbon sinks and their continued management in a sensitive manner, combining biodiversity and production outputs, will be essential to
the drivers
conserving and increasing carbon stocks. Habitats of Principle Importance (ie Section 42 Habitats) including heathland, acid grassland, bogs, fen and ancient woodland are of particular importance, alongside permanent grassland pastures and forestry plantations.

Extensive grazing is vital to restore peat based Section 42 Habitats to a state where they are active and sequestering atmospheric carbon, rather than releasing carbon to the atmosphere and losing peat as sediment into rivers and streams. Likewise, appropriate grazing of open areas within forestry, which could become over rank, will reduce the risk of unintentional fires and the resultant release of atmospheric carbon.

There is still considerable discrepancy between figures estimating how much carbon is being released or trapped by the complex processes by which carbon is exchanged between the land and atmosphere. Nevertheless, these processes do take place and it is essential to examine how the rate at which carbon is lost to the atmosphere can be minimised. There are many other additional and beneficial practices, including supportive elements of Glastir, that can be implemented on farms including:

- Minimum tillage of organic and organo-mineral soils;
- Securing appropriate grazing regimes across areas of peat based habitats to ensure carbon sequestration rather than carbon emission;
- Efficient livestock management to minimise disease and reduce culling rates;
- Adopting grass and clover varieties to enhance sward longevity and productivity;
- Best practice in using fertilisers, slurries and manures to match crop requirements;
- Reducing artificial fertiliser use;
- Planting trees and hedgerows.

**Sustainable land management**

The contribution made by the agricultural industry to the evolution of the Welsh countryside has been mentioned earlier in this document but it is hugely significant and as such it is vital it is not underestimated.

Welsh farmland provides habitats for a wide range of flora and fauna and the landscape created by farming provides a free but valued backdrop for a range of dependant visitor experiences and enterprises. It is currently difficult to put a definitive value on how the quality of the landscape positively influences the rural economy; it is equally difficult to accurately estimate the positive influences it exerts on the well being of those who live and utilise the countryside. However, it is indisputable that it has a priceless value to the people of Wales and remains an essential ingredient to the health, spirit, culture and economy of our country.

Many farm businesses have diversified in recent times and benefit directly from the visitor economy. Increasingly tourists - farmer’s customers - are seeking environmental credentials from their suppliers and it is evident that all businesses that depend for any share of revenue from the modern and future visitor economy must incorporate sustainable green strategies to satisfy this customer need. There are many very good examples of farm diversification enterprises across Wales that demonstrate how revenue can be achieved by positively engaging with sustainable strategies and without having a detrimental effect on biodiversity, water quality and emissions.

**Agri-environment schemes**

Farmers participating in agri-environment schemes to date have had their efforts to improve habitats and biodiversity on their land recognised with five support schemes.

From 2012, the four existing schemes (Tir Cynnal, Tir Gofal, Tir Mynydd, and Organic Farming) will be replaced by one - Glastir. This scheme reflects the Welsh Government’s commitments to water quality, carbon sequestration, soil protection and biodiversity and also the European Union’s CAP Health Check Climate Change Challenge agenda for soil carbon, water quality and quantity management and
biodiversity. Inclusion in the All Wales Element of Glastir is necessary to register for the more detailed elements of the Glastir scheme, apart from the Common Land Element; these include the Targeted Element (TE), and ACRES. Farmers may choose to participate in Glastir or seek other opportunities to remain profitable and sustainable but the responsibility to reduce greenhouse gas emissions and enhance biodiversity remains.

Renewable energy
On-farm, renewable energies are becoming increasingly attractive, particularly with the arrival of Feed-In Tariffs (FITS) in April 2010. FITS provide payment for the energy created, up to five Megawatts, and the government guarantee a minimum payment for the electricity generated and exported to the grid. In addition, the UK Government is also planning to launch a Renewable Heat Incentive scheme in 2011 to provide long term support for renewable heat technologies, from household solar thermal panels to industrial wood pellet boilers.

There are choices to be made on farm about which resources to exploit. Costs for installing the relevant equipment vary considerably. Further information on the different options is available from Farming Connect, but here is a brief synopsis of the choices available:

**Hydro Power:** many streams and rivers in Wales have sufficient flow rate to be able to drive a hydroelectric turbine, something that is necessary as otherwise very costly storage facilities are required. Approval will be required from the Environment Agency and the cost of connection to the National Grid also needs to be considered.

**Wind Energy:** one of the easiest forms of energy to exploit (providing there is consistent wind speed) and small scale set-ups for private use are commonly seen. Wales attracts considerable interest from large scale energy companies and, in addition to all the planning regulations, consideration needs to be given to the impact on the carbon stores when large upland peat areas are disturbed for the installation of wind
farms. The cost of connection to the National Grid also needs to be considered.

**Solar Energy**: can either be used to heat water or for solar conversion to electricity (photo-voltaic). Water heating units are relatively simple and efficient but electricity generating units require much higher capital investment and that often makes them unviable for smaller businesses. For those wishing to install electricity generating units to feed-in to the grid, the cost of connection to the National Grid also needs to be considered.

**Biomass**: a generic term that covers any grown material that can be burnt to produce energy; for example, wood, short rotation coppice, miscanthus and straw. Consideration needs to be given to the land area required, the equipment needed, that land conditions are suitable for harvesting and that there are sufficient and suitable markets locally.

**Heat Pumps**: heat pumps extract heat energy from the ground, air or water and concentrate this into a form that is more useful as an energy source. It works in the same way as a refrigerator that removes heat from inside and transfers it outside the fridge. These systems either utilise a borehole or extended pipes buried throughout a south facing field. Heat pumps work best in buildings that have a relatively low heat demand and are well insulated. They may not be suitable for some agricultural applications.

**Anaerobic Digestion (AD)**: on-farm anaerobic digestion of manures and slurries has the potential to reduce 
\( \text{CH}_4 \) emissions from manure storage and spreading. The AD process converts organic material into biogas composed of \( \text{CH}_4, \text{CO}_2 \) and hydrogen. This gas can be used for heating and electricity production and is therefore a potential substitute for fossil fuels. The residual liquor can be used as a liquid fertiliser and the residual fibrous material is a useful soil conditioner. However, there are several barriers to the implementation of AD on beef and sheep farms, namely;

- Significant quantities of material are required on a continuous basis for the AD process which are not likely to be available on a beef and sheep farm so consideration must be given to importing feedstock from alternative sources;
- There are high installation costs and high costs for obtaining access to the National Grid;
- There is a lack of understanding of the technique and its impact among planning authorities and the general public;
- The digestate is designated waste and is subject to waste management controls.

Renewable energy projects may also require planning permission from local planning authorities and, if connection to the National Grid is required full costings should be obtained before embarking on the project.
The Road Ahead: Opportunities for improving sustainability in the supply chain

No farmer is alone if he or she wants to improve the sustainability of their enterprise. There are many positive actions that farmers can implement on their farms to reduce their greenhouse gas emissions, improve use of resources and prevent pollution incidents - and the majority of these also have the added advantage of improving the productivity and profitability of farm businesses. Technical information, advice and assistance on all related issues have been listed earlier in this document and are available from many sources, including HCC.

Farms

a. Manipulation of ruminant diets
Considerable research has, and is being, undertaken on how manipulating ruminant diets could deliver emissions savings and reduce nitrogen excretion. While some of these technologies may not have reached the market yet other options are currently available to Welsh farmers:

- The use of high sugar ryegrasses (HSG) is a proven technology that is already widely used in the industry. As well as increasing productivity research has shown that sheep fed HSG can have reduced methane emissions of approximately 20%. In addition more efficient utilisation of HSG in the rumen reduces the amount of nitrogen excreted;
- The inclusion of certain fats has also been shown to reduce methane emissions and is potentially easy to include in diets, for example, by including linseed or naked oats in rations;
- Additional options are also under investigation, some of which are showing potential for reducing methane emissions and nitrogen excretion. These include the use of essential oils and allicin. More work is required on these products to determine whether it is cost effective to feed them to livestock and how best to deliver them to the animal;
- Maize silage has been shown to reduce the amount of methane produced per kg Dry Matter consumed when compared with a grass silage based ration. As new maize varieties are developed that are more suitable to Welsh conditions this option may become more accessible in Wales but the nitrogen inputs need to be considered.

b. Genetic improvement of livestock
It has long been recognised that this will lead to efficiencies of production and stock that are better suited to market requirements. Here, in detail, are some of the benefits of genetic improvement:

- Estimated Breeding Values: If stock are selected according to their Estimated Breeding Values (EBVs) and known traits, improvements will be seen to both the maternal and terminal lines. On the maternal side, this will encourage progress in traits such as reproductive efficiency, longevity and milking ability; on the terminal side, growth rates and muscling can be improved resulting in faster finishing times.
Sustainability Scenario

What impact does genetic improvement have on reducing greenhouse gas emissions?
The scenarios below illustrate differences in enteric methane emissions per kg of lamb produced which can be achieved through increasing flock output.

<table>
<thead>
<tr>
<th>Increasing lambs reared by 20%</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rearing percentage</td>
<td>120%</td>
<td>140%</td>
</tr>
<tr>
<td>Reduction in enteric methane emissions per kg of lamb produced</td>
<td>-9%*</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Increasing growth rate of single lambs by 10%</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average growth rate to sale (g/day)</td>
<td>225</td>
<td>248</td>
</tr>
<tr>
<td>Reduction in enteric methane emissions per kg of lamb produced</td>
<td>-1.5%*</td>
<td></td>
</tr>
</tbody>
</table>

Increasing the number of lambs reared and the growth rate of animals is a function of both management and genetics. Farm management practices which can help maximise flock output include improved use of grassland and forage, reduced disease incidence and the use of performance recorded rams.

* The results are based on modelling changes within a single year and exclude longer term implications on female replacement rates, ewe live-weight and cull ewe and ram carcass output. Methane values for maintenance, growth, lactation, pregnancy and activity were estimated using IPCC Tier 2 equations.

These results are produced from a project to develop a unique tool to model the impact that genetic improvement can play in reducing methane emissions during Welsh lamb production. The project, funded by the Rural Development Plan for Wales, has been carried out on behalf of HCC by Aberystwyth University (IBERS) with support from KN Consulting and Innovis.
Longevity: Improving longevity of breeding stock on farms is essential to reducing costs of production. Fewer replacements will be required and the lifetime production of the breeding stock will increase significantly. This provides cost savings and also reduces greenhouse gas emissions with fewer replacement animals being kept and the knock on effects of the associated inputs required.

Fertility: Improving the reproductive fertility of stock allows greater productivity without needing to keep more animals. This can be achieved through selecting animals for improved fertility and by focusing on the nutritional and health requirements of breeding stock at key times throughout the season.

Feed conversion efficiency: An improvement in an animal’s feed conversion efficiency enables them to make better use of modern forage varieties resulting in better utilisation of feeds and shorter finishing times.

Waste: Broadly, genetic improvement can produce an animal better conformed to market requirements and that means less time spent on farm with faster finishing times, in turn leading to a reduction in greenhouse gas emissions, particularly methane. Remember that the market increasingly seeks leaner meat and any excess fat trimmed from carcasses at processing plants means additional costs and lost income for the producer. HCC provides accessible, regional training for farmers to assist them in fully understanding when animals are ready for slaughter for the modern market.

It is important to maintain a broad genetic base of traditional native breeds of livestock suited to harsher grazing conditions. Such breeds bring biodiversity and production benefits through their ability to graze less productive areas and utilise poor quality forage. Native breeds are more suited to outwintering and are less dependent on supplementary feed and its associated fossil fuel emissions. These types of livestock will become more relevant when artificial inputs such as phosphorus become short or unavailable.

c. Animal health and welfare
Healthy and well-nourished livestock will utilise feed more effectively and grow at optimum rates. Animal Health Planning is an essential management tool and there are several purpose made plans available for this purpose with the most effective ones produced collaboratively with veterinary surgeons. Support is available through the Farming Connect Vet Mentors scheme; for members of Farm Assured Welsh Livestock (FAWL) there is an online tool available.

Some medicines and chemical treatments can have a detrimental effect on the environment and farmers are aware that they must be carefully directed and then used in a responsible manner. Planning the treatment and control of such conditions will help to reduce the number of treatments required and assist with a carefully considered approach to product disposal. The Environment Agency Wales provides advice to farmers in areas considered at risk of pollution from sheep dips as part of the Catchment Sensitive Farming Initiative.

d. Grassland and forage management
The climatic conditions in Wales are ideally suited to grass production. This is the cheapest feed source for ruminant livestock and supply can be maximised with careful management.

Seed varieties: considerable research continues to be undertaken to improve the varieties of grass, clovers and other forages available to farmers and thus improving yields and introducing additional benefits such as drought tolerance or more efficient uptake of nutrients. Varieties of ‘high sugar grasses’ are now widely adopted on Welsh farms and are proven to improve productivity while reducing methane production;

Soil and Nutrient management: managing the soil and nutrients on farm in an efficient manner will also lead to benefits for the environment. Targeting fertiliser applications to areas that require it, by making use of soil analysis, will prevent potential pollution incidents of water courses. Fertilisers contribute to the release of
nitrous oxide into the atmosphere and a reduction in their use reduces emissions and provides cost savings for farmers. Farmers can make more efficient use of farmyard manures and slurries as well as the use of clovers and legumes in the swards. Farming Connect offers subsidised Whole Farm plans (which includes a Nutrient Management Plan) where farmers discuss and prepare actions specific to their requirements with a specialist advisor;

- **Use of legumes**: red and white clover are good high protein forages with a high mineral content that have the added benefit of improving soil fertility through their ability to fix nitrogen. Incorporating clovers into swards for grazing and ensiling will increase forage quality and are an important tool for farmers looking to improve their productivity in a sustainable manner.

- **In combination**, the practices used by organic producers have been demonstrated to have the potential to reduce greenhouse gas emissions and can also be adopted individually by any producer. The key practices include reliance on clovers and other legumes to replace synthetic nitrogen fertiliser (see above), and the reduced use of bought-in feeds, relying to a greater extent (though not exclusively) on home-grown forage and arable crops. Recent studies have shown that the buying in of feedstuffs can represent a significant ‘embodied’ use of fossil energy and GHG emissions. Organic standards also emphasise careful management and applications of manures and slurries, including timing of applications to better suit crop growth (i.e. spring better than autumn), which is also recommended practice to reduce nitrous oxide emissions.

- **Forage management**: managing available forage effectively helps provide stock with nutritious feed in appropriate quantities to maximise growth and limit waste. Be careful not to under-stock at key times in the season and maximise available nutritional value (including semi-natural habitats i.e. Molinia being at its most nutritious early in the growing season). HCC provides advice and technical information on how this can be achieved on farms;

- **Maximising the use of grazeable Section 42 Habitats**: Section 42 Habitats (habitats of principal importance, as identified by the Welsh Government) if appropriately grazed, can provide biodiversity and carbon sequestration outcomes together with production benefits from utilising marginal land;

- **Outwintering practices**: outwintering of stock may offer potential benefits for farmers who have suitable land. Such systems require less housing and less ensiled winter forage. The wider environmental benefits of these systems are currently under investigation at IBERS, Aberystwyth University.

- **Maintaining the uplands**: farming’s maintenance of natural, unimproved swards, particularly in the uplands of Wales, deserves greater recognition for the key service it provides to the environment, to rural communities and to the rural economy. Areas where mountain lamb farmers have looked after livestock and landscape for centuries, such as Snowdonia and the Brecon Beacons, enjoy significant tourism opportunities due to the unique vistas and habitat and this brings diversification opportunities for local landowners and businesses. Similarly, commons, and commoning practices, are also integral to agricultural management and deliver biodiversity, carbon sequestration, water quality and flood management benefits to Wales.

- The Welsh uplands provide additional benefits, such as carbon conservation and flood risk management, and it is very important to consider that any change in the use of this land could prove detrimental to the preservation of carbon stocks in Wales. These areas enable the grazing of livestock on extensive systems and do not require costly inputs; they continue to be an important resource, particularly for ruminant livestock effectively utilising this lower grade feedstock. They support unique fauna and flora that are important ecologically and aesthetically. The removal of ruminants from the uplands would have devastating impacts on ecological, social, economic, agricultural and cultural health and it would help sustainability’s cause if there was a wider awareness of the custodial value that farmers impart to such landscapes.

---

18 Increased use of clovers and other legumes in grassland and in arable rotations can potentially make a significant contribution to reducing agricultural greenhouse gas emissions. A significant part of the impact is the reduction in need for synthetic nitrogen, with reduced fossil energy consumption and related CO2 and other emissions at the time of manufacture, as well as reductions in nitrous oxide emissions associated with fertiliser applications. (The embodied energy and emissions from manufacture are not always included in carbon footprint calculations due to either being treated as imports to the UK, or as emissions associated with industries other than agriculture, but they are still an important part of agriculture’s wider impact on the global situation.) However, there is also a need for careful management of the legumes to avoid nitrogen losses that would counteract the benefits.
The Meat Processing Sector

Integration and Innovation: bringing environmental evolution to retail enterprises.

In 2009, the UK processing sector slaughtered 2.9 million cattle (0.13 million in Wales) and 16.7 million sheep (3.8 million in Wales), supplying more than 1.1 million tonnes of meat to the human food chain. In 2011, there were 24 abattoirs operating in Wales, with four plants accounting for over 80% of trade. Most abattoirs had co-located cutting plants although a few only packed products which are harvested in the abattoir (e.g. flanks and offal). In Wales, there are two very large retail packing plants taking meat from the UK and Ireland for the multiple retailers.

Within the last ten years there has been significant consolidation within the industry. Smaller plants have been closing and the larger plants have gained even more efficiencies of scale and financial advantage by their size. Environmentally, this produces a dichotomy; the movement to rationalise means less water and energy is used per head and less waste and GHG are produced per tonne of meat in the larger plants; however, there is inevitably an increase in food miles. Smaller, local abattoirs may use more water and energy per head but offer farmers more choice, are an important employer in rural areas, reduce transportation costs and cut food miles, producing important environmental benefits and become a useful marketing tool.

Waste management in the meat industry is highly regulated but it can be difficult for businesses to obtain information about the relative costs of the disposal options, which may involve more than just a collection charge. The meat industry generates two main waste streams; by-products and packaging.

Some by-products can be used to produce pet food, edible oils, biodiesel and fertilisers but these are options that are often more difficult for many of the smaller plants. For the larger plants, it will make economic sense to harvest some of these products, enabling them to reduce the proportion of the carcase rendered.

The other main waste stream is unrecyclable plastic, especially from the large retail packing plants. This includes multiple layered, thermformed, post-process plastic but does not include paper and cardboard which is recycled. This plastic plays an important role in food hygiene as it protects the meat during aging, transit and in storage and at present options for reducing or recycling remain very limited.

Water and processing

Meat processing compares favourably with other food sector industries and is not a heavy user of water. A recent HCC project19, funded through the Rural Development Plan for Wales 2007 – 2013, has shown that on average 4.2m³ of water is used to produce a tonne of beef or sheep meat during the slaughtering, cutting and retail packing processes. However, there was huge variation on this figure, depending on the type of processes adopted within the plant and whether it was a single or multi-species plant. While there are many opportunities for reviewing the systems and making changes to reduce water use, the project showed that very few plants currently sub-meter the water at the point of use but instead rely on water bills (either monthly, quarterly or annually) to monitor their water use.

Water is used for watering and washing livestock and for the abattoir cleaning processes. Containment of infectious diseases is clearly very important and transport vehicles are washed upon site entry and exit. In many abattoirs and retail packing plants, water consumption has risen to an extent in recent years due to increased processing activity (e.g. in beginning to recover more fifth quarter materials) and the adoption of new, more efficient practices (e.g. replacing boxes with reusable plastic trays that need cleaning). All abattoirs and cutting plants must comply with the Food Standards Agency (FSA) in accordance with legislation under 853/2004, which requires the use of potable water for almost all washing and cleaning operations. Despite the requirements of legislation, there are opportunities for reducing water use.

Water consumption in a meat factory is dependent upon the amount of floor area used including lairage and yards as well as management practices such as;

19 | The HCC funded project showed that few companies had a breakdown to establish the exact quantities/volumes of trade effluent (see footnote 20) produced. Total average discharges were estimated at 3.09 m³ per tonne in cattle plants (abattoir/cutting) and 2.06 m³ per tonne in sheep plants.
Wash down procedures of all production, processing and management areas;
Automation of carcase dressing systems;
Lorry washing controls;
Trade effluent\textsuperscript{20} management and water recycling;
Personnel wash stations;
Cutting and retail packing plant equipment.

The Federation House Commitment (FHC) is a UK voluntary agreement under which signatories contribute to a food and drink industry target to reduce water usage by 20\% by 2020 against a 2007 baseline. WRAP (Waste and Resources Action Programme) is responsible for working with signatories to achieve the target and to encourage further uptake with companies in the food and drink sector. There are currently no Welsh red meat companies signed up to this Commitment.

Energy
Increases in energy costs, coupled with Government initiatives to reduce energy consumption, pose an increasing challenge for companies. Survey work has shown that managing energy use is still in its infancy in much of the meat industry. Energy costs for many meat plants represent the fourth highest operational cost (after the cost of raw materials, waste disposal and labour) and are seen as one of the factors that determine competitive advantage. More companies are using more electricity and hot water because of increased levels of processing, yet few companies have the means of breaking down where the most energy is used throughout the plant (i.e. very few plants sub-meter at point of use).

Electricity is used for refrigeration and compressed air, as well as for ventilation, lighting and powering equipment in the slaughter, boning and by-product processing areas (e.g. saws, hoists, conveyors, packing machines and electrical stimulation). Gas and oil are primarily used to provide heat and hot water for the factories (e.g. for scalding, knife sterilisation, cleaning process areas and machinery, by product processing and heating). A small minority of plants are solely reliant on electricity for all forms of energy.

The survey information showed that it takes on average about 775 kWh of energy to produce a tonne of beef and 685 kWh per tonne of sheep meat (based on the energy used for slaughtering, cutting and retail packing), although the energy per tonne varied considerably depending upon the type of processes within the plant. While few plants currently utilise renewable energy technologies, they are becoming increasingly attractive, particularly with the Government incentives that are now available.

Controlling Waste
There are many areas (post farm gate) where waste can be reduced including:

- Farmers can ensure they produce healthy animals for slaughter that meet the marketplace requirements and abattoirs can provide better information to farmers on any evidence of any diseases found such as liver fluke;
- Meat is wasted during processing, distribution and retail which has a significant monetary and carbon cost to the businesses involved. Improvements need to be made throughout the supply chain to ensure waste is minimised. Improvements in packaging and processing need to be investigated to increase shelf life while continuing to match the highest standards of food quality and safety.

\textsuperscript{20} The Environment Agency classifies Trade Effluent as any liquid waste produced in the course of the work of any trade or industry which is discharged to the waste water system. Any company wanting to discharge significant trade effluent into a river, stream, estuary or the sea must obtain a trade effluent consent which is described in Schedule 10 of the Water Resources Act 1991. It is a legal document that sets limits on the volume and nature of the discharge. In the livestock industry, effluent is predominantly made up of water from cleaning activities. For smaller facilities it may be cheaper to have it commercially collected than to bear the cost of installing a treatment plant.
The Retail Sector

The retail sector - supermarkets, butchers and other stores and shops - are the part of the industry that is the most visual to consumers and they understand they are under a constant expectation to continually make improvements to benefit the environment while, essentially, remaining cost effective. They have both willingly and enthusiastically accepted the role that they have in reducing the carbon footprint of lamb and beef. Increasingly, butchers shops embrace and promote the benefits of reducing ‘food miles’. They actively source their product as locally as they can and display these origins proudly within their shops, providing the consumer with a valuable insight into and reassurance about the food they are eating. Food waste in the home is another area that needs greater addressing and retailers and other organisations throughout the industry can contribute towards educating and informing consumers.

The following charts (shown below) highlight the important position that the major retailers have in lamb and beef sales:
The drive for sustainability has produced a positive integration bonus through an improved and closer working relationship between parts of the supply chain. Retailers are now working with producers at farm level to ensure they receive quality products produced in a sustainable way. Many farmers are encouraged to undertake carbon footprinting exercises to identify areas within their business where carbon production can be reduced. This can be very beneficial to producers, particularly when benchmarked against other producers. A good example of this is the beef and lamb carbon footprints that have been undertaken by farmers supplying Sainsbury’s. Over 600 farms in Wales have participated in this and the information collected has identified areas where improvements can be made. Sainsbury’s will now facilitate targeted farmer meetings on issues such as grassland management, fertiliser and manure management and animal nutrition.

Supermarkets have taken up the challenge to provide consumer value and quality while adopting strategies to reduce the carbon footprint of food, ensure its sustainability and convey these actions to customers. Activities are undertaken at every stage of the supply chain. Tesco, for instance, undertook a study to identify the impacts made by the stages of the supply chain on the carbon footprint of lamb. It identified that apart from the obvious elements of the rearing stage as described above the use of the product in the home accounts for a further 6.2% of the carbon footprint. This showed the importance of educating consumers to buy wisely, use the product efficiently and minimise waste.

Marks and Spencer’s have similar signature schemes to those retailer-producer collaborations mentioned earlier and actively encourage the participation of their producers to learn how the entire supply chain works. This enables them to understand the issues affecting the retailers such as seasonality, consistency and sustainability. Marks and Spencer, as part of their corporate responsibility, have developed Plan A. Launched in 2007, Plan A sets out 180 commitments to achieve by 2015 with their ultimate goal being to become the most sustainable major retailer. The five areas where they are focussing their attention are Climate Change, Waste, Sustainable
Raw Materials, Health and Being A Fair Partner.

ASDA have developed a ‘Sustainable Suckler Scheme’ to encourage genetic improvement in herds. This proven heifer scheme is available to ASDA BeefLink members and allows farmers to breed offspring from their heifers without those animals being penalised when they are themselves slaughtered. This scheme increases the volume of beef produced on farm and significantly reduces the carbon footprint of beef as the animal being slaughtered does not need to ‘carry’ the carbon footprint of its mother.

The retailers have very close associations with the processors and, in some instances, will own their own processing businesses. There are many opportunities for reducing water and energy consumption within the processing factories as already outlined and additional strategies include reducing packaging, refrigeration, transport and waste. Research is continually ongoing to provide packaging alternatives that present a product in an attractive way to consumers but uses less plastic. A Bristol University project, supported by DEFRA, ASDA and HCC, is investigating methods for reducing waste in the supply chain including the reduction of packaging, seen by many consumers as an extravagant use of plastics. A benefit of reducing the bulkiness of packaging could be to reduce the storage and haulage requirements and therefore reducing the amount of energy required for refrigeration and transport.

Some of the larger retailers are investigating anaerobic digestion as a method of diverting food waste from landfill. Recycling is another key way to reduce the amount of waste going to landfill.

Energy use in the retail sector provides ample opportunities for improvement and strategies being implemented by Morrisons and Marks and Spencer include;

- Improving refrigeration systems such as those that utilise CO₂ rather than more harmful greenhouse gases;
- The introduction of renewable energy technologies for energy supply and heating;
- Reduced transportation through local sourcing and more efficient distribution;
- Reduction in plastics through use of re-usable carrier bags.

Alongside the requirement to reduce the amount of carbon produced in food production is the need to promote a more ethical approach to food production and consumption. Welsh Lamb and Welsh Beef can play a pivotal role for retailers in achieving this objective. Excessive packaging is costly to produce and purchase in the first instance and there are also significant disposal costs incurred by the industry and consumers, who are showing a greater intolerance of unnecessary marketing or inadequate packaging. Practically, reductions in bulky packaging would lead to more efficient transport as well as reduced disposal requirements.

HCC is confident that, by adopting the strategies laid out in this document – A Sustainable Future - The Welsh Red Meat Roadmap - the twin targets of both addressing the challenges posed by climate change and maintaining momentum towards commercial efficiency can be achieved. HCC pledges to practically support and encourage all producers whenever it can in this process and offers this Roadmap as an outline of the opportunities for assistance to achieving these targets that are available to farmers in Wales.
Appendix

Strategic context – In detail: additional and existing associated policies and support strategies in Wales.

The following have all been either consulted and considered during the development of this roadmap to ensure strategies and actions suggested in this document are not conflicting with any current policy.

The Food Strategy for Wales: Food for Wales, Food from Wales 2010 - 2020. This is a ten year, overarching, directional strategy which has been developed in collaboration with the industry and the public. It aims to balance the need for increased food production with the need to protect the environment and outlines a clear direction for the Welsh food industry to grow in a sustainable and profitable way while taking into consideration crosscutting issues such as health, food culture, education, food security, environmental sustainability and community development.

Foods under the wider Welsh brand should demonstrate the following:

- The adoption of good agro-ecological practices, including measures to reduce production-based greenhouse gas emissions;
- Compliance with high animal welfare standards;
- A contribution to the sustainable management of resources such as soils, fishing grounds, water and landscape;
- Increased energy efficiency and lower carbon emissions throughout the food chain.

The Strategic Action Plan for the Welsh Red Meat Industry is specific to Welsh beef, sheep and pork farmers and to the associated supply chain. Its primary aim is to support the Welsh red meat industry and monitor and report on any developments and improvements made.

Towards Zero Waste is an overarching waste strategy document produced by the Welsh Assembly Government that will also create detailed sector action plans. Of relevance to Welsh Beef and Sheep industry will be the Agricultural Waste Plan and the Food Manufacture, Service and Retail Sector Plan.

Farming, Food and Countryside: Building a Secure Future was published in May 2009. This document outlines the Welsh Assembly Government’s policy direction to secure a sustainable future for the land based industries in Wales through to 2020. This roadmap supports many of the policies outlined in the document and will assist in their implementation.

EU Water Framework Directive came into force in December 2000 and the Environment Agency Wales is the lead authority in Wales for implementing its strategies. It will help to protect and enhance the quality of surface freshwater (including lakes, streams and rivers), groundwaters and ecosystems dependant on groundwater, estuaries and coastal waters out to one mile from low-water. Each member state is required to work to a management plan specific to the river basins that they manage with the aim of protecting and enhancing ecosystems, promoting sustainable water use, reduce pollution of...
groundwater and contribute to mitigating the effects of floods and droughts.

**The Water Resources Strategy for Wales** was published by the Environment Agency Wales in June 2009 with the aim of working with a wide variety of organisations to secure water supplies and ensure a better water environment for future generations. It seeks to meet future challenges that will be presented by climate change and demands for water from food production and other industries in Wales.

**The Environment Strategy for Wales** was published in 2006 by the Welsh Government and sets the strategic direction for the environment in Wales up until 2026. The vision is for the distinctive Welsh environment to be thriving and contributing to the economic and social wellbeing and health of all people in Wales. It covers themes such as addressing climate change, using resources sustainably, developing distinctive biodiversity, landscapes and seascapes, reducing pollution and developing local environments as a valuable resource for people.

**A Living Wales** is one of the major statements of policy principle by the Welsh Government. It is about more effective governance of environmental resources in Wales within the context of sustainable development, a central organising principle. Further details can be found at: www.wales.gov.uk/livingwales

**The Climate Change Strategy for Wales** was launched in October 2010 by the Welsh Government and outlines delivery plans for the different sectors to reduce greenhouse gas emissions and enable effective adaptation in Wales. A key element of this strategy is adapting to changes in climate that have already taken place and measures to support this will be put in place via the Adaptation Framework.

**The Land Use Climate Change Report** (March 2010) and is an assessment of the science relating to emissions from the agriculture, land use and food sectors in Wales and outlines a way forward for these sectors to achieve significant reductions in greenhouse gas emissions by 2040. Among 49 recommendations, it recognises the importance of grassland-based farming systems to the range of eco-system services (including food and fibre production) delivered in Wales. The report also recognises the need for Wales to contribute fully to the production of food to meet global challenges of food security, and importantly not to displace the greenhouse gas (GHG) emissions associated with food production to other countries.