

The Milk Roadmap

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Produced by the **Dairy Supply Chain Forum's**
Sustainable Consumption & Production Taskforce



The Dairy Supply Chain Forum’s Sustainable Consumption and Production Taskforce has been chaired by Dairy UK and draws membership from the following organisations who have worked in partnership to develop the Milk Roadmap:



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1. Executive Summary

Introduction

1. A Roadmap identifies the environmental impacts of a specific product throughout the supply chain and then sets short, medium and long term targets for reducing that product's environmental footprint. Defra is developing 10 pilot Roadmaps of which the Milk Roadmap is the first to be published.
2. The Milk Roadmap sets out measures to further reduce the environmental impact of producing, processing and consuming liquid milk. Although businesses in the liquid milk supply chain have already taken significant steps to reduce their environmental footprint, further industry-wide cooperation and agreed commitments will enable that process to accelerate.
3. Key stakeholders including dairy farmers (producers), milk processors, retailers (supermarkets) and consumers have led the creation of this document, with co-ordination from Defra and support of a dairy industry taskforce. The Taskforce has been chaired by Dr Ed Komorowski, technical director of Dairy UK.
4. The Roadmap is intended to be a 'living document' that will be reviewed periodically by the stakeholders. The first review will take place in autumn 2008. This allows progress towards targets to be monitored and makes it possible to revise and update the targets in the light of new data or new technology.

About the dairy sector

5. UK dairy farms produce between 13 and 14 billion litres of raw milk each year. Around six billion litres of that is processed into liquid milk – mainly for drinking.
6. England has approximately 10,000 dairy farms, with a further 6,000 in Scotland, Wales and Northern Ireland, all ranging in size. The average English dairy farm has 100 cows¹.
7. Although there are more than 100 dairy processors in the UK, seven major milk processors account for more than 90% of the UK's liquid milk supply. They sell bottled milk to the main grocery retailers, food service companies and for doorstep delivery by the milkman.

Producer targets

8. Dairy farmers' commitment to improving environmental performance is ably demonstrated through their uptake of numerous environmental initiatives. These range from nutrient planning and water efficiency measures to protection and maintenance of the rural environment.
9. As a result of the Roadmap, the farming sector will undertake to increase the amount of farmland managed under the Environmental Stewardship Scheme (ESS)

¹ DairyCo Datum, 2008 and Kingshay Data.

to 65%, encourage 90% of dairy farmers to nutrient plan, improve water efficiency by up to 15% per litre of milk and aim for 95% of dairy farmers to have a Herd Health Plan. Thereby enhancing and conserving farm ecosystems, improving animal health, saving water resources and reducing air and water pollution through nutrient losses.

10. Looking ahead to 2020 the dairy farming sector will also strive to reduce the Greenhouse Gas emissions balance by 20-30%, use 40% of energy from renewable sources, and recycle/recover 70% of non-natural on-farm waste.

Processor targets

11. Milk processing sites have long striven to improve their environmental performance ahead of regulatory requirements. Processors are already engaged in a number of environmental initiatives and many processing sites have the environmental accreditation of ISO14001. Now they have undertaken to send less waste to landfill, source more renewable energy and cut energy and water use compared to 2007 levels.
12. Half of all milk packaging will come from recycled material by 2020, while 20% of non-transport energy will come from renewable sources or from combined heat and power systems. Water use will also be reduced by 30% in absolute terms.
13. Carbon dioxide emissions will be reduced ahead of the challenging targets set in the Climate Change Agreement with the dairy sector. Nitrogen dioxide emissions from gas boilers will also be cut through the introduction of new technology.

Retailer targets

14. Most retailers include environmental commitments in their corporate social responsibility (CSR) policies, and are insisting that suppliers adhere to strict environmental criteria.
15. The Roadmap suggests that major multiple retailers should establish positive and direct (where appropriate) relationships with producers (farmers) and processors to support the delivery of the targets for producers and processors in the Roadmap.
16. The work of transferring retail commitments to the Roadmap is not yet complete. However, the retail sector is committed to energy and water reduction targets in the future, cutting the environmental footprint of old and new stores alike and raising the proportion of recyclate in packaging.

Living document

17. The stakeholders in the dairy sector have purposefully set the targets on liquid milk to be ambitious. Next steps for the Roadmap for producers and processors will be to gather the appropriate data so that the success of the targets can be measured. For retailers, the next step will be to provide measurable targets, such as a target for reduced CO₂ emissions.

18. A monitoring plan is in place and representatives from each part of the supply chain will monitor progress towards achieving these targets between now and 2020.

2. Introduction

The Milk Roadmap has been produced by the Sustainable Consumption and Production Taskforce of the Dairy Supply Chain Forum in order to reduce the environmental impacts of liquid milk.

This work forms part of a pilot of ten Roadmaps with a focus on priority products, good and services. For information about the other Roadmaps, please visit the following web page:

<http://www.defra.gov.uk/environment/consumerprod/products/index.htm>

For the Milk Roadmap, liquid milk was chosen as a starting point for a number of reasons, including the fact that virtually all milk consumed in the UK has been produced in the UK, enabling evidence on milk to be mapped relatively quickly and clearly. The UK dairy sector was also willing to engage fully in this process.

The Milk Roadmap is a tool to help us to better understand the environmental, social and economic impacts of milk, and the various ways in which these impacts can be mitigated. As a starting point the Roadmap identifies the impacts that occur across the milk lifecycle, and defines a vision to reduce these impacts without adversely affecting the long-term sustainability of the sector. The Roadmap also sets a course of practical actions, including short, medium and long-term targets, to deliver this vision.

The Milk Roadmap will remain a living document which will be reviewed periodically in order to allow progress in attaining the various targets to be monitored, and the targets themselves to be revised if necessary in light of new evidence and research.

3. Scope

The Roadmap focuses on the milk supply chain and encompasses all activities involved in the production, processing and consumption of milk. This begins at the farm (including pre-farm inputs) and follows on to the processing of the milk, the distribution to the retailer and finally the sale of the milk to the consumer.

The scientific tools for quantifying the various impacts in the milk supply chain are still under development in some areas (for example, the Carbon Methodology or PAS 2050 currently being developed by the British Standards Institution with Defra and the Carbon Trust). The Taskforce decided to continue to progress with the Roadmap due to the positive environmental outcomes that are envisaged despite the tools for quantification still being developed. Instead, in the Roadmap as presently drafted, the Taskforce has identified the known environmental impacts in the liquid milk life cycle, and has identified practical targets and means for minimising them where possible. The Taskforce has also agreed to keep the Roadmap under review as a living document to allow scientific progress to be incorporated appropriately, and to allow quantification methods to be incorporated in the measurements and processes as and when they become available.

The Milk Roadmap considers practical and achievable ways of reducing the environmental impacts associated with liquid milk using current patterns of production and consumption. The Roadmap does not consider alterations to the size of the dairy sector.

The Dairy Supply Chain Forum, which has led on the production of this document, covers England only. Consequently the scope of this report should be taken to be England only although much of the research quoted could apply to the UK as a whole.

4. Vision

The Taskforce's vision for 2020 for the dairy sector is that of a sustainable industry working to improve its performance in the areas of environment, economics, and social welfare. These aims are encapsulated in the following Vision Statement:

“Achieving sustainability by working to improve the environment while prospering in a free competitive market place through the supply of safe, healthy and nutritious foods.”

5. On-farm

The Roadmap identifies areas where environmental performance can be improved, without threatening the economic viability of the industry. In doing so the Roadmap should not marginalise the economic and social pillars of sustainability in favour of the environment but recognise that they are essential to it. The ability of dairy farmers to deliver environmental, economic and social benefits depends on the viability of the business and therefore the targets presented should be achievable within economic boundaries.

5.1 Dairy Farming

It is worth setting out the context in which the dairy farming sector finds itself in 2008. The number of dairy farms has fallen dramatically over the last twelve years, from over 22,000 dairy farms in England in 1996, to a total of just over 10,000 dairy farms in February 2008. As dairy farmer numbers have fallen production has consolidated on fewer and fewer units. Consequently it has also tended to intensify: the 'average' dairy farm in England has around 100 milking cows, although of course this masks large differences in actual farm sizes and structure.

Dairy farmers in the UK are amongst the largest and most efficient in the European Union. At the same time, genetic and management improvements in dairy cattle have seen the average cow increase milk production from 5,000 litres a year in 1989 to 7,627 litres in 2007². As a result of improvements in cow yields, farmers are getting the same amount of milk from fewer animals and as such cow numbers have also fallen by about 20% since 1996. Total production in England currently stands at over 9 billion litres of milk per year.

Dairy farms are predominantly family run units although the consolidation of the sector has increased the exposure to employed labour. Geographically, milk production has tended to gravitate towards those areas with the greatest advantages, particularly the western side of England (as well as Wales and Northern Ireland) where grass production is supported by higher rainfall and a mild climate. This means that to some extent, concentrations of production have become more divorced from the places where liquid milk is consumed, i.e. major urban conurbations.

The economics of dairy farming are pivotal to underpinning the sector's environmental performance and sustainability. Until very recently, milk prices have been constantly exposed to persistent market pressure. This has contributed to the decline in farm numbers and a gradual

² DairyCo Statistics, 2008

decline in English milk production as well as generally low levels of reinvestment in units compared to major competitors elsewhere in northern Europe. Whilst raw milk prices have seen dramatic increases since the middle of 2007, pressure on incomes and farm confidence remain as a result of ever higher input prices.

5.2 Dairy Farming and the Environment

Many of the potential environmental impacts of the dairy sector are more closely related to farm management practices than simply herd size and cow numbers³. In recognition of this the industry is working towards reducing its impacts, for example, by producing the Environmental Plan for Dairy Farming (EPDF).

The EPDF highlights the efforts currently being made by dairy farmers to improve their environmental performance. Critically the focus of the EPDF is on promoting integrated solutions to improving environmental performance. By this we mean straight-forward activities that tackle more than one environmental problem. The three central tenets of the EPDF are encouraging the take-up of nutrient planning, supporting registration of land farmed by milk producers into the Entry Level Stewardship scheme and supporting best practice through demonstration (e.g. DairyCo Focus farms, work of Catchment Sensitive Farming Officers, engagement with private consultants and so on). The integrated approach, through relatively simple solutions, reduces the risk of pollution swapping and ensures greater ownership of environmental risks by farmers.

In line with the best practice solutions advocated in the EPDF there are a wealth of industry initiatives and tools focussed on delivering the Plan on the ground, these include:

Farming Futures: A communications project which provides advice to farmers on the risks, responsibilities and opportunities that climate change presents, and on what farmers can do to reduce greenhouse gas emissions and adapt to the impacts of climate change.⁴

Climate Change Taskforce: A joint NFU/CLA/AIC activity throughout 2007 which summarised a series of contributory science-based background papers into a final report, concluding with a number of recommendations and research needs, emphasising how agriculture is part of the solution to climate change and where industry and Government should work together.

DairyCo Environmental Focus Farms: In line with the EPDF DairyCo has established 8 focus farms to provide an educational resource for dairy farmers in adopting environmental best practice at the legislative level. The concept of small groups of farmers coming together to discuss common issues on these representative farms will stimulate change at an earlier opportunity.

LEAF: Integrated Farm Management promotes a countryside that is alive with wildlife, but one that crucially supports viable farming businesses. There are a number of impressive dairy farmer case studies, not least the dairy farmers who are also LEAF members through their Dairy Crest – Waitrose contract.

Effective use of water on the dairy farm: DairyCo booklet containing information on understanding use on farm, the costs, how to use more efficiently, leak detection, recycling, rainwater harvesting, abstraction and bore holes and full farm water audit template. In the first 2 months of launching the booklet some 300 copies were requested by dairy farmers. The EA, LEAF

³ IEEP, 2007

⁴ www.farmingfutures.org.uk

& NFU have also recently produced 'Waterwise on the farm' a guide to implementing a water management plan. Since the launch of the booklet, some 1250 copies have been distributed.

PLANET: A computerised version of Defra's industry standard RB209 which can be used to develop nutrient and manure application plans⁵. PLANET helps users better integrate the nutrients from manures with fertilizers, with the potential to make savings on additional fertilizer required and also aids compliance with NVZ regulations and Cross Compliance.

Professional Nutrient Management: NFU CLA, AIC LEAF and FWAG are in consultation with Defra to update the "Tried and Tested" document to provide basic guidance for farmers on nutrient management planning.

Dairy Industry Achievements

Embarking on the Roadmap process requires an acknowledgement of environmental achievements the industry has made. The dairy industry has invested a great deal of time and effort in researching where the most significant environmental impacts of dairy farming occur. These are set out below:

Greenhouse Gases (GHGs): Since 1990 methane emissions, often negatively associated with livestock, have fallen by 13.5%⁶. Whilst not intentional, this reduction is attributable to a decline in the number of dairy cows, which is a result of improvements in management strategies such as feed efficiency and higher yields. In short, dairy farmers are producing more from less and are helping the environment in the process.

Fertiliser Use: Overall fertiliser usage in agriculture has reduced by some 30% over the last 10 years⁷, with a reduction of Nitrogen application to dairy farms of 46%⁸. The significant reduction in application rates of all three nutrients (N, P and K) to grass cut for silage has been achieved mainly due to the restructuring of the dairy sector - fewer farms (-27%) and decline in dairy area (-14%). This change marks a decline in the less efficient enterprises, which have been consumed by larger more management intensive herds. The need to continually drive unnecessary costs out of the farming business and the need to comply with the Nitrates Action Programme measures has also lead to improvements in nutrient management. This provides an example of a 'win-win' situation, where improvements make both economic and environmental sense. There is still scope for Nitrogen efficiency improvements, however, and the role of current FACTS Qualified Advisors and animal feed specialists needs to be further realised.

Water, Land and Air Pollution: An Environment Agency report 'Putting the Brakes on Climate change' published in September 2007 revealed that serious pollution incidents caused by farming were down by 35 per cent to their lowest ever level in 2006. The report included an assessment of the number of serious pollution incidents (categories 1 & 2) from agriculture to water, land and air. EA also reported that agriculture accounted for less than 10% of serious pollution incidents in 2006.

Nutrient Management and Planning: Improvements in nutrient planning are being enabled through the work of private consultants, animal feed specialists, fertilizer advisers, agronomists and DairyCo who are generating materials and tools that allow dairy farmers to better understand,

⁵ See Glossary for definitions

⁶ eDigest Statistics: UK Emissions of Greenhouse Gases, Defra, 2007

⁷ British Survey of Fertiliser Practice (1976-2006) The BSFP Authority, <http://www.defra.gov.uk/farm/environment/land-manage/nutrient/fert/bsfp.htm>.

⁸ British Survey of Fertiliser Practice Survey 1995-2005

implement and benefit from nutrient management planning. Defra's recently published Nitrate Vulnerable Zone (NVZ) Consultation, and Environment Agency, data both reveal a declining trend in N levels in watercourses at various monitoring sites.

Environmental Stewardship: An interim report commissioned by Defra revealed that over 5000 dairy farmers had contacted Defra up to June 2006 to enquire about Environmental Stewardship - the highest level of interest of any livestock sector. An updated interim report published in 2007 revealed that over 35% of dairy managed land is entered into Entry Level Stewardship (ELS).

The most popular ELS options amongst dairy farmers included: manure management plans – over half of dairy farmers in ELS selected this option⁹, protection of in-field trees, hedgerow and ditch management and maintenance of woodland fences.

Water Use: In terms of water use, 79% of dairy farmers responding to the NFU Water Survey in 2006 said they were more aware of water efficiency than they were 5 years ago. 91% of dairy farmers who responded carried out at least one of the following water saving tactics: insulating pipes to prevent leaks, emptying and closing unused pipes in the winter, employing leak detection systems, having stop valves and/or drain valves at pipe locations or having trigger controls on hoses, hand lances and washing equipment, 73% of dairy farmers employ two or more of these methods. Furthermore, a recent report by Waterwise (2007) suggests that the water used per litre of milk produced in the UK is up to 200 litres less than other dairy producing countries, including Italy, Australia and Denmark.

Biodiversity: Dairy farming and the landscape it supports is key to the conservation of the greater horseshoe bat (one of our priority UK Biodiversity Action Plan species). Cow pats are necessary in the life cycle of dung beetles which are an especially important food for young horseshoe bats. The cow pats act as both a food source and habitat for the larvae. Up to 100 larvae can be found in a single cow pat and this beetle is at its most abundant in early August when the young bats begin their first feeding flights.

Conversion of old permanent pasture to arable land has been identified as key to the decline of the species. As such, dairy farming and its landscape of permanent pasture with linear boundary features and ancient woodland, can make a significant contribution to the recovery and survival of the species.

Natural England provides the following specific example of where dairy farming is clearly contributing to the recovery of this species: "During autumn 2001 an organic milk producer operating within the landscape around the largest roost in the UK started featuring the bats on their milk cartons. A simple message is used to illustrate the link between extensive agriculture and providing abundant insect prey for the bats."

5.3 Drivers of Environmental Performance

It is evident that the sector has been working hard to make reductions in its overall environmental footprint. These reductions have been made for a number of reasons – for example, in response to consumer demand through retailer-led initiatives, or because in many cases environmental savings result in efficiency and monetary gains. Farmers can and will respond to the need to go even further, preferably through incentives and voluntary initiatives. Regulatory approaches clearly

⁹ The proposal to withdraw management plans from the ELS options is of great concern to some dairy farmers as it will threaten the viability of existing agreements.

have a part to play: however, in line with better regulation principles, these must be proportionate and positively promote the desired changes.

Responding to the consumer

Consumers are increasingly making lifestyle choices which they believe will reflect positively on the environment, or in those areas where they have an interest. The market has started to respond to this. For example, a number of retailers now offer their producers a premium price for delivering consumer identifiable benefits, which may include enhanced environmental performance.

Retailers are increasingly seeking to measure the carbon footprint of their liquid milk supply chains and are keen to achieve reductions through investment and incentives at farm level¹⁰. It is important that in seeking to measure carbon footprints that a common, scientifically robust methodology is universally adopted.

The importance of dedicated retail supply chains in delivering environmental improvements should not be understated since in return for demanding higher standards on farm, which can in turn be communicated to consumers, retailers are able to guarantee that the producers undertaking additional efforts are rewarded through milk prices that reflect true costs rather than commodity markets.

The dairy industry has also been responding directly to consumer demand for environmentally-friendly products as well as driving change. This can be seen through the increased production of organic milk, wildlife-friendly milk, or use of recycled materials in milk bottles.

In the future it is likely that consumer demand for local, quality assured, environmentally beneficial and / or sensitive products will grow. It is important that British dairy farmers are able to meet this demand.

Reducing Costs through Improved Efficiency

As production costs continue to rise farmers are striving to reduce costs through improved efficiency. In many cases improving efficiency and improving environmental performance are inextricably linked. This has been demonstrated in the case of water use. 41% of dairy farmers responding to the NFU Water Survey were undertaking additional measures to increase their water efficiency; on average spending some £1811 per farm; 68% of dairy farmers who responded to the survey also recycled or reused some of their water, which is higher than any other agricultural or horticultural sector surveyed.

In recognition that it is water efficiency as opposed to water use reduction targets that will achieve the best environmental outcomes, DairyCo has recently released (at the request of dairy farmers) a new publication 'Effective Use of Water on Dairy Farms' demonstrating innovative methods of water management that can save the business thousands of pounds as well as deliver positive environmental outcomes. This is another example of a win-win scenario where both economic and environmental benefits are achieved.

Work by IGD's Food Chain Centre (2002 – 2007) demonstrated that improved collaboration along the dairy chain coupled with the application of a lean approach to supply chain management could lead to reduced costs which in turn can result in a more benign environmental impact. A wider

¹⁰ We understand that Asda is currently developing a carbon foot printing model and that the Sainsburys' Dairy Development Group standards will also include a carbon foot printing methodology.

application of this approach across the industry is capable of delivering significant economic and environmental benefits.

Single Payment Scheme and Decoupling

The reform to the CAP in 2003 removed any incentive for farmers to produce for subsidy. Decoupling means that farmers no longer have to keep unprofitable enterprises running in order to receive subsidy; rather, changes in support policies are driving improved environmental performance. Dairy farmers are able to claim under the Single Payment Scheme as long as they deliver certain environmental goods by meeting cross compliance requirements on their land. Voluntary modulation also contributes to Rural Development Funds, available under Axis 2 for environmental projects.

Environmental Regulation

Environmental regulations are driving changes in practice. Proposed changes to the Nitrates Action Plan, the Water Framework Directive and Climate Change and air quality legislation impact on the dairy sector.

5.4 The Future for Dairy Farming

In 2020 the dairy industry could look very different and this will undoubtedly influence the impact it has on the environment. In order to make realistic projections as to what the dairy industry can achieve it is important to consider how the industry may have changed by 2020. A number of key factors that might influence this are outlined below.

Further reform of the CAP, including the end of milk quotas in 2015, is likely to exert further competitive pressure on dairy farmers across the EU. The loss of export subsidies by 2013, notably, will probably reduce the value of butterfat on the EU market which in turn will affect the price of bulk cream as a by-product of liquid milk production. As with all competitive pressures, this will push dairy farmers to get bigger in order to cut costs. Predictions are that future herd sizes will increasingly range from 300-1000 (average herd size stands at approximately 100 cows currently).

However, the lifting of milk quotas also provides the UK, as a competitive milk producer, with a long-term opportunity to become a more significant player in EU and world markets. If the market stabilises at a sufficiently high level then dairy farmers will certainly look to increase current production levels. The British dairy industry could potentially be playing beyond its current capacity.

Increasing costs of production and particularly higher feed prices may have consequences for the way farmers manage their systems. If feed costs remain high, and labour costs continue to rise, many producers could move towards seasonal production profiles. The environmental consequences of which will have to be studied in more detail. One likelihood is that a move towards a more grass based system will reduce the amount of bought-in feed, which is often imported, thus reducing the carbon footprint. However, in order to maximise output it is likely that more fertiliser will have to be applied to grassland. Milk processing and haulage are also likely to be affected. Seasonal calving patterns are not the most efficient for processors in terms of milk delivery and processing capacity.

Increased labour costs will also reduce the amount of time employees have to spend on conserving, enhancing and protecting the environment. Reduced labour increases the length of the working week for farmers, which currently already stands at approximately 70 hours, thus reducing the time farmers have available to attend training courses and seminars to inform farmers of environmental schemes and improve their land management skills.

The role of retailer is one that is increasingly engaged in what happens at farm level. There are a number of dedicated supply chain relationships now in place in the UK, a major part of which is producing to higher environmental standards in return for a premium price. It is envisaged that this transparent relationship between retailer and supplier will strengthen in the future, enabling consumer demands to be better communicated to the farmer, who can then tailor their product and management style in return for a higher price.

The globalisation of dairy markets implies that there will be further rationalisation of dairy processing businesses, in order to both achieve greater economies of scale and secure market presence in the key global markets with increasingly global retailers.

Furthermore, global economic and population growth will grow demand for dairy products and in turn production. The UK dairy sector can act as a global sustainability leader through the actions contained in the Milk Roadmap.

Technology, Research and Development is critically important in improving the competitiveness and environmental performance of the UK dairy industry and its role cannot be underestimated. It is essential that funding and time continues to be invested to ensure that British dairy farmers are well placed to take advantage of new technologies and advances in breeding, feeding and other environmentally and economically beneficial areas. This must be achieved not only through the industry levy body, but through continued Government investment in research that challenges current husbandry best practice; an area which has great potential for improved environmental performance.

5.5 Enhancing Environmental Performance: What more can be done?

In light of the predicted future changes to the dairy industry and considering the drivers of environmental performance integrated solutions to environmental challenges can be further encouraged in a number of areas. These opportunities and limitations are detailed below.

Greenhouse Gas Balance

A carbon footprint (or greenhouse gas balance, depending upon whether only CO₂ or a range of greenhouse gases are considered) measures emissions per unit of product, from all aspects of production up to the farm gate, and onward through the supply chain to the consumer. This may include all farm inputs, emissions from the livestock themselves, energy used in field operations and farm buildings, and energy used in processing and distribution. Opportunities exist for dairy farmers to improve their greenhouse gas (GHG) balance through, for example, the use of on-farm anaerobic digestion (AD), use of biofuels in agricultural vehicles, increased energy efficiency, and increased feed efficiency. Wider opportunities exist for processors and the supply chain as a whole through centralised AD, which can process food wastes together with manures.

Currently there is a dearth of mature research investigating cost effective ways of reducing GHG from dairy farms. The success of any measure is dependent on the cost of implementation and the effectiveness and suitability of the measurement itself; however, there are a number of interventions based on animal feeding and productivity which are available to dairy farmers that provide an opportunity to reduce GHGs per litre of milk produced. Some of the more feasible mitigation methods to reduce methane emissions include:

- Improving the ratio of methane emissions per unit of product, by increasing cow longevity
- Increasing milk yield per cow (recognising that on many units yields may already be at optimum levels in terms of economic viability and animal welfare)

- Enhancing the efficiency of rumen microbial action through changes in diet type, and the use of feed additives to reduce methane production
- Avoidance of low quality forage that stimulates methane production
- Increased take-up of anaerobic digestion (AD) to produce biogas and reduce uncontrolled methane emissions from stored manures and slurries. AD can also export low-carbon electricity and heat services, which should be given credit in any overall greenhouse gas balance though it is recognized that this is not an option for all dairy farms.
- Nutrient planning to ensure that the efficiency of nitrogen utilization in plants and animals is optimised, thereby reducing the overall emissions of nitrous oxide and methane

DairyCo and EBLEX are currently investigating dairy diets, the manipulation of which has the potential to reduce GHGs generated through enteric fermentation. The outcomes of this project will inform further research considering 'designer diets' which maximise feed efficiency and maintain the necessary outputs while reducing methane emissions from the individual animal.

DairyCo is also part of a plant breeding research programme that is developing plant protein sources (Lupins) that can be grown in UK conditions to reduce the need for the importation of dairy feed ingredients and thus reduce the environmental impacts of importing feed. This would effectively reduce the carbon balance by increasing the use of home grown proteins.

Constraints and Challenges: The enteric fermentation inventory currently uses animal numbers as a proxy for emissions. Consequently, only methods that reduce the number of animals register as a reduction in emissions. The inventories need to be refined to take account of changes brought about by dietary manipulation and other technologies.

There is also potential for an on- farm measurement system that will aid farmers in the necessary investment decisions to manage their environmental impacts accordingly.

Nitrogen efficiency

Nitrogen efficiency, i.e. matching nitrogen inputs to crop and livestock diet requirements offers the most attractive option for reducing soil nitrous oxide (N₂O) emissions. It addresses several issues, such as N₂O emissions, nitrate leaching and ammonia emission, without pollution swapping and has no secondary or knock-on effects. Manure and nutrient management, advisory and regulatory initiatives offer significant scope for improvement. However, while nitrogen is clearly the focus, improvements in nitrogen efficiencies cannot be achieved without the correct overall balance of all other key livestock and crop nutrients.

Constraints and Challenges: An integrated approach to nutrient management by both farmers and their various advisors will be essential if improved efficiencies are to be fully realised. While at present a range of nutrient management tools are available many are over-complicated and are not being taken up by dairy farmers. For many farmers nitrogen planning under the revised Nitrates Action Programme proposals will be a big step. Nutrient planning more widely across the dairy industry will require more 'user friendly' tools to be developed.

Water Efficiency

It is likely that environmental constraints associated with the water environment will become more stringent as the Water Framework Directive is implemented regionally by the River Basin Management Plans. Much work is already being done; however, there is a need for national roll out of voluntary schemes that work in tandem with existing incentives such as Environmental Stewardship.

There are some real challenges with regards to water resource availability for all sectors, not just agricultural, and particularly in those areas defined by the Environment Agency as water stressed. The industry is already promoting water use efficiency and water auditing and we consider that these initiatives will continue into the future. It is important to remember that much of the water used on dairy farms is for animal drinking water and dairy hygiene (i.e. parlour washing) and therefore any reduction in usage must be achieved through improved efficiency and must not compromise animal welfare or food safety.

Constraints and Challenges: For nutrient management a simplified approach is needed, a clear delivery mechanism is required and a measure of the financial benefits of nutrient planning. In terms of water use efficiency there will be a limit beyond which water use reductions cannot be undertaken without affecting the milk yield, animal health or hygiene. It is clear that there will always be a baseline volume of water that is needed to ensure these important elements are not compromised.

Non Natural Waste

Following the introduction of the Agricultural Waste Regulations in 2006, dairy farmers now have to comply with rules that have applied to other business and industry sectors for many years. As a result, many dairy farmers have joined farm waste schemes which facilitate waste collection and reprocessing/recycling.

The main component of non-natural waste for dairy farmers is farm plastics. Defra is expected to introduce a statutory Producer Responsibility (PR) scheme for non-packaging plastics in late 2008/early 2009. This will put the obligation on the producers and importers of non-packaging plastics, such as agricultural films and wraps, to pay for their collection and disposal/recycling. This is likely to stimulate greater collection and recycling of farm plastics and is likely to be target driven. Details on possible targets are yet to be released.

Constraints and Challenges: While some specialist waste collection and recycling infrastructure has developed naturally in response to the introduction of the Agricultural Waste Regulations, recycling levels are inhibited by insufficient recycling infrastructure and excess contamination levels. Those companies involved in reprocessing plastics from other industries or municipal waste streams are reluctant to accept farm plastics due to the contamination levels involved; hence there is currently limited opportunity for farm wastes to piggyback onto other existing reprocessing infrastructure.

It is hoped that the introduction of the PR scheme could act as a tool to drive the market by presenting more of an economic opportunity. Private capital will invest in reprocessing infrastructure where it sees a return. We await Defra's consultation on the PR scheme.

In addition, it is important to note that certain types of material (e.g. parts of fertiliser and feed/seed bags, veterinary medicines and animal health products, baler twine & net wrap) may not be recyclable and may have to be sent to land fill.

Animal Health

Reducing levels of mastitis and other cattle related diseases reduces the use of antibiotics through improved herd health and will lead to improved productivity. Increasing cow longevity and average lactations also reduces the need for replacement heifers and reduces energy consumption, while improving the input to output ratio per cow.

A healthy herd is an efficient herd and if disease is present not only does the welfare of those animals affected suffer, but also the productivity of the herd is compromised. Plans can be created to reduce the risk of introducing disease, and to recognise, treat and control existing conditions. Farm Assurance Schemes such as Assured Dairy Farms (ADF) recognise the benefits of Health Plans, and have included them in their standards, as part of the assurance of animal health and welfare (BCVA).

Through the Cattle Health Initiative Defra is funding 27 projects in the beef and dairy sectors in England to promote the use of **active Farm Health Planning** (FHP). It is estimated that these projects will have engaged and involved over 7500 dairy farmers by March 2008. Broadly, the projects aim to promote the benefits of FHP, raise awareness of FHP through targeted communications, advice and training and to generate a network of farm health planning champions. With ongoing support this initiative could expand and develop to provide far reaching benefits to livestock farmers throughout England.

Proactive FHP is further encouraged and supported through the England Cattle Health and Welfare Group (ECHAWG), which is made up essentially of farmers, veterinarian representation, and levy board representatives. The responsibility of ECHAWG is to ensure the delivery of the GB Animal Health and Welfare Strategy (AHWS) to the cattle sector in England. EBLEX and DairyCo have provided a grant which is being used to fund a secretary for the group in recognition of its importance and value to the sector.

DairyCo Breeding+ data indicates that cow longevity in the UK is up there with the best developed dairy nations and continually improving. Recently the selection index for bulls in the UK has seen a major swing away from production (previously 65% of the weighting) to the more 'fitness' traits that aid cow longevity.

As well as Government and industry, retailers and milk buyers have an increasing role to play in improving herd health. A number of retailers are developing schemes to improve herd performance through dedicated supply chains.

Constraints and Challenges: DairyCo and Eblex have taken a proactive response to provide funding and secretariat support for existing projects and groups, but we consider that there is a wider need for continued support for Cattle Health Initiatives. There is a need to break down cultural barriers and foster an inclusive approach with the veterinary industry to enable meaningful progress on proactive herd health planning. We must also recognise that producers are having to deal with the aftermath of Foot and Mouth Disease, the present problem of bovine TB and learning to tackle new threats such as Bluetongue.

Generation of energy from renewable resources

The use of combined heat and power, biomass boilers and anaerobic digesters (AD) is being pioneered in the dairy industry by a small number of innovative dairy farmers. The Roadmap should recognise the potential that exists for the sector to further offset environmental emissions through the use and production of renewable energy through these and other means. This is consistent with the overall NFU aspiration that its members in every farming sector should have the opportunity to export energy services, through the provision of professional advice from the NFU Energy Service and its delivery partners.

Due to economies of scale and cost of electricity grid upgrades, investment in AD for smaller dairy units may require collaboration between several farms. It is essential that the forthcoming

EA/WRAP digestate standard and other environmental regulations facilitate the transfer of both manures and digestate between smaller farms.

Constraints and Challenges: Large capital investment, planning constraints and the volume and range of input material required are all limitations to anaerobic digestion.

Agri-environment Schemes

The 35% of dairy managed farmland that is currently entered into the Entry Level Stewardship (ELS) is already delivering a broad spectrum of environmental benefits, notwithstanding the significant economic and social benefits it provides. However, there is definite scope to improve the level of uptake of ELS and higher level agri-environment schemes amongst dairy farmers. To achieve this the benefits and accessibility of the schemes must be communicated and promoted to farmers. In addition farmers must be equipped with the knowledge and skills required to manage the land in an environmentally sensitive way.

Constraints and Challenges: A number of farmers report difficulty in accumulating the points required to register for the schemes. In order to improve rates of uptake and capitalise on farmers' willingness to engage in environmental schemes Government must review options available to dairy farmers to broaden accessibility.

The withdrawal of management plans as options could threaten the viability of some existing agreements and therefore undermine efforts, as in the EPDF, to secure wider environmental benefits through sign-up to ELS. It is thought that the hardest hit segment of the farming population will be small, specialist dairy farmers, who, with limited land could struggle to accumulate the points target required without the option to undertake management plans. In future we should seek to avoid measures that discourage the take-up of management plans as simple, effective and integrated solutions to different environmental problems.

An extension of the no-cut period for hedgerows and increase in minimum hedge height, as presently being proposed, could result in many dairy farmers no longer including hedge options in future agreements

The level of Higher Level Stewardship (HLS) funding is limited and is a potential barrier to dairy farmers wishing to progress from progressing to higher level conservation and environmental enhancement. In order to measure the level of uptake more accurately Government must make Environmental Stewardship participation figures readily available.

Integration of beef and dairy supply chains

The close relationship between the beef and dairy industries should not be ignored. A significant proportion of beef reared for consumption in the UK originates from the dairy herd in the form of bull and cow beef as well as cross-bred heifers that become part of the suckler herd. However, there are opportunities both to develop markets and reduce environmental impacts by ensuring that more dairy beef enters the beef supply chain rather than being 'wasted', such as through the humane dispatch of calves at birth. A number of retailers are investigating how both dairy and beef chains can become more closely integrated.

Greater use of the 5th quarter of cattle (notwithstanding constraints in respect of Specified Risk Material) e.g. through tallow burning for energy, could also bring environmental benefits (through reduced direct incineration/ landfill).

6. Processing & Distribution

6.1 Milk Processing

The UK produces between 13 and 14 billion litres of milk each year which is then processed into a wide range of dairy products. Almost half of the milk produced on farms in the UK is processed into liquid milk. Despite the reduction in milk production on the farm over the last three years, the production of liquid milk has grown over the same period.

There are more than 100 dairies in the UK, varying widely in size. Most are small processing sites (for the purposes of the Milk Roadmap these have been identified as those sites processing less than 50 tonnes per day of pasteurised milk). However, the UK dairy processing industry is relatively concentrated and is dominated by seven major milk processors at 40 sites together accounting for more than 90% of total processed liquid milk sold to grocery retailers in the UK. “Large” or “major” processors are defined in the Milk Roadmap as those processors that process more than 50 tonnes per day of pasteurised milk.

The majority of the industry’s product is packaged for direct consumption by the consumer. In turn the majority of these products are distributed through a chilled distribution chain. About 80% of liquid milk sold by retailers is in plastic containers, with only about 20% of milk sold in glass bottles or cartons. Even within chilled distribution, the majority of the industry’s output is perishable with a limited shelf life. Consequently distribution and chill chain management is one of the fundamental activities of the processing sector.

6.2 Milk Processing and the Environment

Dairy processing sites are increasingly facing stricter and more widespread regulation. Approximately 50 dairy processing sites are covered by the Environmental Permitting Regulations (formerly the Pollution Prevention and Control (PPC) regulations). This is a regulatory system that employs an integrated approach to control the environmental impacts of certain industrial activities. It involves determining the appropriate controls for industry to protect the environment through a single permitting process. To gain a Permit, Operators will have to show that they have systematically developed proposals to apply the Best Available Techniques (BAT) and meet certain other requirements, taking account of relevant local factors. Sites that process an annual average of 200 tonnes of milk per day are required to meet the requirements under this regulatory system.

The key environmental issues affecting milk processing sites are:

Energy Consumption

The dairy industry is considered an energy intensive industry. Energy use at a processing site can lead to direct emissions to air (from on site combustion activities, generally of natural gas), or indirect emissions to air (from combustion activities that occur at the power generating site as a result of use of receiving power from the grid). Energy is used for running motors on processing equipment, for generating steam for heating processes, evaporating and drying, for cooling and refrigeration and for generating compressed air. Heat treatment and subsequent cooling account for a large proportion of direct energy use. Water use also gives rise to limited energy consumption, both in terms of pumping mains water to site and also through on-site processes.

The primary global environmental impact associated with energy consumption (from electricity delivered by the grid) is the production of the greenhouse gas CO₂. These are influenced by the level of consumption and choice of energy source.

Energy performance data from UK liquid milk manufacturers compare favourably against operators from Europe, Australia and other countries.

Emissions to air

Direct emissions can occur from combustion activities on site for generating heat or electricity. In addition to CO₂, these emissions may include NO_x (nitrogen oxides), PM₁₀ (particulate matter), SO_x (sulphur oxides) which are largely dependent on the fuel selection. It is an inherent factor within the food, drink and dairy industries that emissions of Volatile Organic Compounds (VOC) and odour arise, for example from drying and other processes, including effluent treatment. Emissions of dust and particulate material can also be a factor from milk powder drying and the transfer of materials. Odour emissions can be problematic, not only because of the sometimes subjective nature of the problem, but as emissions tend to be fugitive¹¹. Other fugitive emission considerations include those potentially arising from refrigeration, cooling and effluent treatment systems.

Water consumption & effluent management

The sector is a relatively large water consumer, the vast majority of which is used for cleaning, both manually and in CIP (cleaning in place) systems, which are widely used throughout the industry. In addition to minimising water consumption, measures to optimise water use have been implemented as important pollution prevention measures relating to effluent management. There are a number of opportunities to either reuse water (for example low-grade wash waters) or to recycle water from for example membrane systems subject to meeting legislative standards.

Dairy UK has established a water efficiency benchmarking system for the sector. Evidence from this demonstrates that the best performing site had water use per unit of product of approximately 0.5 litres water used per litre of milk produced and the average ratio was 1.3 litres water used per litre milk produced. To reduce the water consumption ratio from 1.3 to 0.5 throughout the industry would save approximately 5.6 billion litres of water per year.

Waste management

Commercial considerations mean that the waste product is minimised. Waste water effluent is produced as a result of cleaning and sanitisation and must be adequately treated prior to discharge either to the sewer, or potentially a natural watercourse. Other waste is minimal and can only be described as general waste and maintenance waste. Opportunities for recycling and reuse of these streams are also considered. Commercial considerations mean that the controls of parameters such as process yield and product wastage are usually understood. These parameters are also key pollution prevention issues as product loss accounts for a significant proportion of the sectors environmental impact.

Other factors

Transport, and the greenhouse gas emissions associated with this activity, both in terms of raw milk to the dairy and finished product to the customer, is an important consideration. Packaging also has important environmental implications associated with manufacture and disposal. High-density polyethylene (HDPE) bottles are the most common packaging type for milk in the UK with glass bottles representing only 11% or so.

¹¹ Fugitive emissions tend to be those emissions that are uncaptured emissions released to the outside environment that may be as a result of leaks, or via windows, doors, vents and similar openings.

Environmental Management & CSR

The dairy processing sector contains a number of large and international companies with advanced environmental management systems (EMS) in place. Many of these EMS are externally verified and comply with international standards, for example ISO 14001. All of the major dairy companies operating in the sector have adopted environmental or sustainability policies and are increasingly reporting environmental performance to stakeholders.

Corporate Social Responsibility (CSR) is the concept that organisations have an obligation to consider the interests of customers, employees, shareholders, communities, and ecological considerations in all aspects of their operations. This obligation is seen to extend beyond their statutory obligation to comply with legislation. CSR is closely linked with the principles of Sustainable Development, which argues that enterprises should make decisions based not only on financial factors but also on the immediate and long-term social and environmental consequences of their activities.

All the major dairy companies have clearly set out principles which they follow and these include fundamental issues such as maintaining high standards of corporate governance, provision of a safe working environment free of discrimination and intimidation, supply of products and services that meet all contractual obligations, compliance with all relevant legislation (Health and Safety, Food Safety and Hygiene, Employees rights etc.), education with regard to nutritional information, making a positive contribution to the local community and ensuring that proper environmental standards are maintained.

6.3 Initiatives for the Dairy Processing Sector

Dairy processing covers a wide range of operations and products and the industry recognises the importance of mitigating its environmental impact if it is to continue to benefit society in a sustainable manner. To that end, the industry has been developing a series of parallel initiatives in conjunction with the trade body, Dairy UK, and other governmental and industry stakeholders which aim to meet this objective. In setting out a vision for the processing and distribution section of the Milk Roadmap, the industry has brought together the key elements from these parallel initiatives to form one consolidated and coherent vision for 2020.

i) Environment Agency Sector Plan

The dairy processing industry has been working closely with the Environment Agency (EA) in England & Wales throughout 2007 to develop a 'sector plan' which identifies and addresses the priority environmental issues resulting from its activities. The purpose of the sector plan is to:

- Focus on the most significant risks and impacts that the sector poses to the environment;
- Deliver improvements in the sector's environmental management and performance;
- Prioritise and target efforts for the next 5 to 15 years;
- Achieve, through cooperation between the EA and the sector, environmental benefits beyond those which can be achieved through regulation;
- Monitor progress in delivering environmental improvements within and between sectors.

Over the past 20 years the dairy manufacturing sector has reduced its impact on the environment but the industry still faces challenges. Targets for emissions will continue to get tougher and improved resource utilisation will be of increasing interest.

Whilst the sector plan initially focuses on impacts attributable to the manufacturing arm of the dairy industry (a similar plan for dairy farming having already been published), it may be that some improvements necessitate engagement with other influential players, including the retail sector.

Based on a strategic review of the sector's environmental issues, the plan aims to identify high level environmental priorities and objectives for the next five to fifteen years. The aim is to achieve these environmental objectives through a programme of key actions for industry and the EA covering both statutory and voluntary activities. Indicators of performance have been proposed for the effectiveness of these actions.

The EA is keen for information to be reported publicly, enabling progress towards measurement of sustainable development within the sector whilst enhancing public trust and confidence in the food supply chain.

ii) Food Industry Sustainability Strategy (FISS)

The dairy processing industry recognises the contribution that other relevant programmes and initiatives can make to the development of the Milk Roadmap, most notably the Food Industry Sustainability Strategy (FISS). FISS was published in 2006 with the aim of helping the food industry contribute towards the UK's sustainable development goals.

Since the publication of the Strategy, Defra and the food industry have been working together to create action plans based on the headline targets in the Strategy. The industry led Champions' Groups were established to identify where progress can be made. The groups examined current best practice, looked at ways of working and have identified barriers which may discourage the industry from behaving in a more sustainable way.

The commitments and targets from FISS and its Champions' Groups have been considered and referenced in the process of producing this dairy processing sector document.

(iii) Benchmarking & Reporting

Dairy UK is working in partnership with the Environment Agency and Envirowise to develop a comprehensive environmental benchmarking tool for dairy processors. The system will address a series of key performance indicators (KPIs) which will be aligned with the EA sector plan and have been put forward in consultation with the EA. The tool will enable the sector to monitor the effectiveness of the actions contained in these plans.

Dairy UK is preparing to publish the first dairy processing sector annual sustainability report in 2008. This will provide for public reporting of industry environmental data collected by Dairy UK through the benchmarking exercise outlined above. The report will allow year-on-year profiling of environmental performance demonstrating improvements made and the effectiveness of mitigation strategies (for example, those set out in this Roadmap). The report will also set out a series of commitments agreed by the industry to further improve performance in future years.

Objectives and benefits of the benchmarking and reporting initiative include:

- Greater transparency and public accountability
- Promoting achievements made by the industry
- Identifying and promoting industry best practice
- Prioritising actions for sites, companies and the sector
- Reducing costs and maximising efficiency
- Leading and setting the environmental agenda

- Tailoring support services

Dairy UK will be the administrator for the KPI tool, and Envirowise will offer third party verification of the data submitted. Envirowise have also agreed to offer tailored support services in the form of best practice guides and onsite workshops to assist the industry in its goal to reduce its environmental footprint.

Energy: Climate Change Agreements

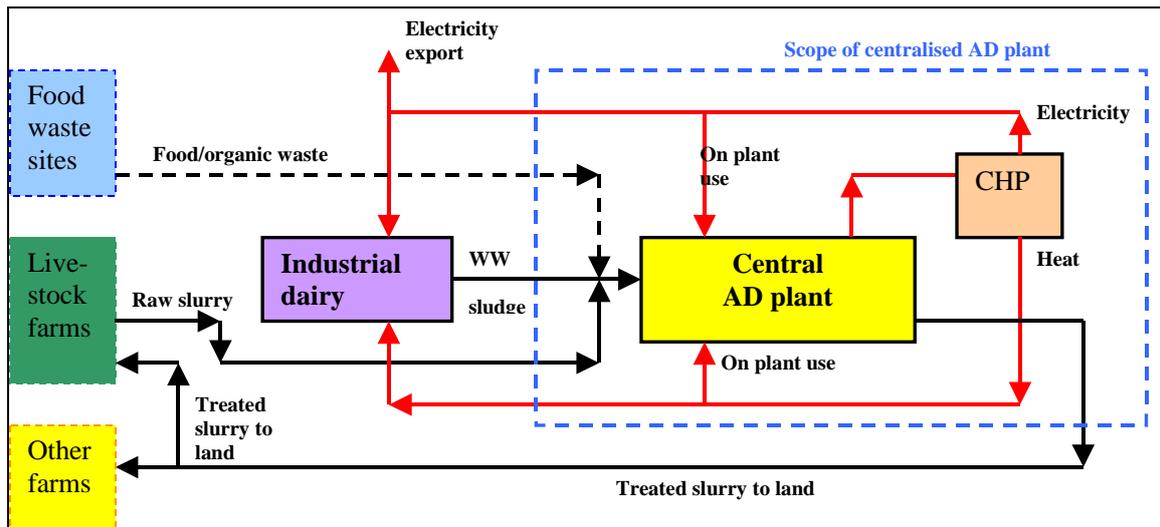
Since its introduction in 2001 Dairy UK has managed the dairy processing sector Climate Change Agreement (CCA) which has covered over 150 processing sites over this period. CCAs have proved an important mechanism for increasing awareness of energy management in the dairy sector and have accelerated investment in low-carbon technology. Furthermore, the systematic collection and reporting of energy data during the life of the scheme has enabled Dairy UK to monitor and track sector energy efficiency. Since 2001, the dairy processing sector has reduced relative energy consumption (kWh per tonne of product) by 17%, despite an increase in production during this period of 13%. 18 dairy processing sites are also caught by the requirements of the European Emissions Trading Scheme (EU ETS).

The sector welcomes the Government's decision to extend the CCA scheme to 2017 and views CCAs as central to achieving further energy efficiency improvements in future.

Renewable Energy: Centralised Anaerobic Digestion

Dairy processors are increasingly looking for new and innovative ways of reducing energy use and associated costs. Anaerobic digestion (AD) is a well-established and proven technology capable of converting low-value organic materials, for example food and agricultural waste, into high value renewable energy in the form of methane-rich biogas.

Given the great potential for AD to contribute to renewable energy, carbon reduction and waste management objectives, in parallel with on-farm AD, Dairy UK has been investigating the commercial and technical feasibility of exploiting centralised AD within the dairy supply chain throughout 2007. The model being explored by Dairy UK is to develop centralised systems (see figure below) based at or near to dairy processing facilities where there is a ready supply of organic waste (from onsite effluent treatment processes) and a demand for energy. These systems would take advantage of the close proximity of the majority of dairy processors to primary producers by importing and co-digesting livestock manures with dairy processing waste.



The figure shows that the Centralised AD plant can co-treat wastes from a variety of food processing sites, alongside that from dairy processors. It generates stabilised waste (which is often referred to as digestate) and methane rich biogas. The digestate can be re-used back on dairy farms as well as other farms in a way that can help to reduce the use of artificial fertilisers; whereas, the biogas can be used in a combined heat and power scheme to generate electricity and heat, both of which can be used in the dairy processing plant.

Sustainable Packaging Systems

The dairy industry is leading the way in reducing the amount of plastic used in poly-bottle drinks packaging. Over 3 billion high-density polyethylene (HDPE) milk bottles are manufactured in the UK each year, using 120,000 tonnes of plastic. Over the past 10 years bottle weights have been reduced by 10%. Over the next three years recycled material will be introduced reducing the quantity of virgin material used by 30%. HDPE milk bottles are 100% recyclable and Recoup has verified that approximately 37% of milk bottles are currently recycled compared with a total bottle recycling rate of 25%. The dairy processing industry has also developed a returnable product transport system – the ‘roll container’ system – which requires no tertiary packaging.

rHDPE Launch in UK

The project to develop the reuse of post consumer plastic milk bottles back into new plastic milk bottles started in 2002, led by WRAP.

After extensive testing and development of a process for creating “super cleaned” HDPE material for use in contact with milk, the product was launched with Marks and Spencer’s Organic Milk range in February 2007. This was after accreditation from the Food & Drink Administration in the USA and meeting all EEC and UK guidelines and food contact requirements.

Announcements have recently been made by various companies who are investing in plants in the UK to produce rHDPE material, including Closed Loop London, Waste Exchange Services and Nampak. These investments will enable recycled material to be included in all UK plastic HDPE milk bottles.

Targets are:

- 10% addition rates to be achieved by 2010 or sooner
- 30% addition rates to be achieved by 2015 or sooner
- 50% addition rates to be achieved by 2020 or sooner

The success of this initiative is due to the team work between the milk processors, retailers, packaging suppliers and government support.

In addition to reducing the tonnage of virgin material used by ultimately around 50,000 tonnes, this success will reduce carbon emissions and also landfill requirement without significant reinvestment by the dairy processors .

Continued success in this area will depend upon the growth in doorstep collection of recycled post consumer waste from the doorstep which is being encouraged by DEFRA and WRAP, and needs to be supported by initiatives from Local and National Government

Transport

Many dairy operators have invested in the construction of in-plant blow-moulding facilities for their packaging suppliers. In one case this has resulted in 27,500 fewer lorry movements and 1.1 million miles less per annum.

6.4 Processing - Enhancing Environmental Performance

The dairy processing sector, including milk processors, have already made significant headway in reducing its environmental impact through tighter regulation, increased investment and voluntary mitigation strategies. However, the industry recognises that more can be done to encourage wider uptake of best practice. In the previous section, we have recognised the work already achieved. In this section, we propose plans for future achievements.

Some specific aims are:

Energy reduction – for processing

The use of inset energy generated from farms and other renewable supplies, the use of recognised energy efficient equipment in new purchase or upgrades, and the specification of energy efficient design and construction of new build facilities will significantly reduce the carbon footprint of the dairy sector. The factor of reduction will depend on a combination of fiscal and regulatory measures.

Air emission and fuel usage reductions from transport

Transport emissions will be reduced through the implementation of more fuel-efficient engines, new injection technology. The use of waste-derived bio-diesel could eliminate fossil fuel derived emissions. Fiscal incentives to invest in new technologies such as the use of the hydrogen or bio-methane fuel cell technology for power could eventually deliver a closed loop system of energy use. This cleaner energy technology and further collaboration within the food chain will deliver a significant means of reducing emissions.

Water reduction and reuse

The technology to reuse water by treating and recycling effluents is established, and is continually improving. Provided that consumer and customer attitudes can change by assuring product integrity, and environmental benefits from treating water are not negated by higher energy inputs, milk processors will continue to achieve even greater water savings.

Energy reduction – for refrigeration

The application of significant technological improvements in refrigeration and heat pump technology, a concentration on the use of the most appropriate refrigeration gas, and the harnessing of waste heat in absorptive chilling will assist in a step change. Taken together with supply chain agreements avoiding refrigeration requirements in excess of shelf-life needs for refrigerated products to be chilled, could achieve a halving of the energy requirements for refrigeration. This will require both investment and collaboration between legislators, regulators and the whole dairy supply chain.

Waste recovery and diversion from landfill

Processing will envision zero waste to landfill, as all solid waste will either be reused, recycled or recovered. Liquid wastes will either be bio-digested, or recovered. This will be achieved through further improvements in both financial incentives for capital investment on farm and through the development of recycle, energy from waste and composting markets.

Recycling and recovery of packaging materials

By ensuring that all milk packaging is restricted to recyclable or recoverable materials, processors will be able to target a “zero waste to landfill” vision. Provided that significant improvements are made to the reprocessing capacity, and that public attitudes towards recycling are altered to ensure correct behaviour, it is possible that an entirely closed loop system for milk product packaging use can be achieved.

Communication

Public attitudes to packaging will be shifted towards maximising recovery by concerted efforts of all those in the milk supply chain to reduce unnecessary extra packaging, by local authorities fiscally rewarding recycling activity, and by the continued communication of successful recovery initiatives.

7. Retailing and consumption

7.1. The Retail and Consumption of milk

Consumers

Consumers are often the top decision-makers in the milk supply chain. How much milk they consume will be a key determinant of milk’s environmental impact.

The way consumers purchase milk also has an impact on transport emissions. For example a majority of people drive to supermarkets and purchase milk as part of their weekly shop. Milk is also a key product at local convenience stores and is delivered direct to doorsteps.

Milk consumption can also generate its own further set of environmental impacts unconnected with the supply chain. The way milk is stored and the amount and way it is heated are two ways that use energy as part of consumption choices. Some milk is wasted and with it goes all the embedded carbon, water and energy resources. Milk packaging could also end up in landfill where re-cycling facilities are not available.

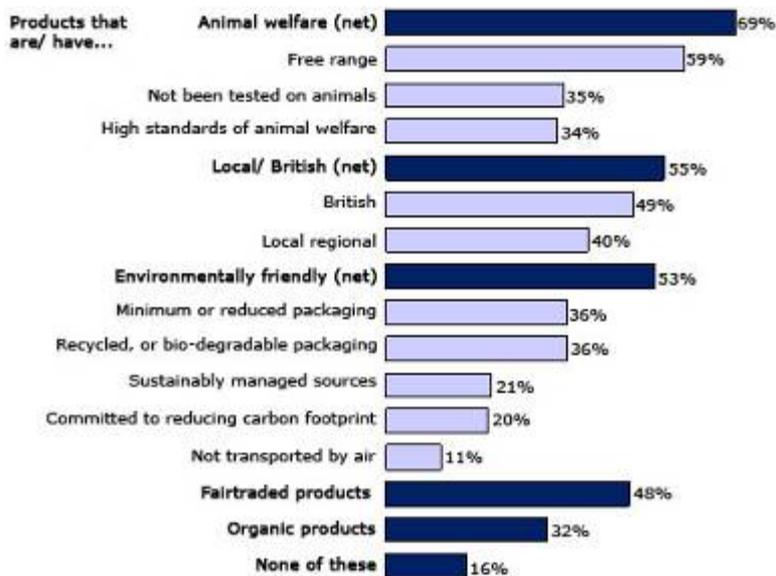
Robust data are not available to provide an overall assessment of milk consumers’ environmental impact. For some areas there is an imperfect understanding of consumers’ behaviour and how this may lead to environmental outcomes.

Quantities

Household milk consumption has been falling over the long-term and at a rate of about 1% annually since 2003-4. Consumers have switched from whole milk (falling at 18% annually) to skimmed and semi-skimmed milks (increasing by 5% annually).

There has been a large increase in the number of milk products, for example different pack sizes, different ‘types’ of milk (local, organic, filtered) and in the branding of milk as suppliers have strived to differentiate their products. Products like organic and local milk have increased in sales (from a low base) since their introduction.

While price and taste remain key drivers, consumers are increasingly interested about where their food has come from and other ethical considerations. Recent IGD research covering all food products indicates that animal welfare issues and provenance are the main areas understood by consumers to be ethical issues.



Source: IGD Research

The research also shows that some milk product types which have been increasing in consumption, namely environmentally-friendly, organic and local products could involve an ethical consideration. However consumers may have other motivations driving interest in these product types, for example, health, taste, product quality, local economics and patriotism.

This research indicates that over eight in ten shoppers are interested in some sort of ethical product. Older or richer shoppers are, not surprisingly, more likely to show an interest in ethical shopping, however these issues are increasingly universal and around three in four 15-24 year olds and low income households also express some interest.

Where from?

Consumers purchase milk from a variety of outlets:

Supermarkets	65%
Convenience stores	23%
Doorstep Delivery	7%
Internet/Farm Shops/Other	5%

Source: DairyCo

There has been a long term increase in the proportion of milk bought from supermarkets. This will be associated with an increase in car usage as consumers typically drive to store for their weekly shop. In contrast milk deliveries to people’s doorsteps has declined from its 30% share of the market in 1984. Although there has been a small increase in internet shopping it is not yet a significant factor in milk purchasing.

Research by the RAC indicates that while the average number of shopping trips per person has fallen by over 13% in the last 10 years, the average length of trip has increased.

Waste and recycling

According to WRAP, UK households are responsible for 6.7 million tonnes of food waste and an additional 5.2 million tonnes of food related packaging. Further research is required on the composition of household food waste though one study in 2004 indicated that 45% of households discard some milk in an average week.

WRAP indicate that 73% of all packaging (by weight) can be recycled though only 31% actually is, and some 68% of England local authorities provide a milk carton collection service via kerbside schemes.

7.2 Existing Retail Initiatives

The following are examples of ways in which the retailers involved in the Taskforce have shown their commitment to the environmental agenda:

Asda

Since 2005 ASDA have saved over 43 million road miles and 50,000 tonnes of CO₂. This has been achieved through rethinking logistics (including over 6000 additional supplier collections), new rail routes, and reducing hauling of empty trailers. In addition, the use of double decked trailers is anticipated to save 5.3 million miles in 2008. 5 million road miles have been removed from the liquid milk chain as a result of ASDA's Dairylink dedicated segregated milk supply operation.

Technological advances including nitrogen fridge trailers (which saves 860 tonnes CO₂/yr), automatic gear boxes on transport systems (which saves 354,000 litres fuel/yr) and cleaner engine technology are being phased in to help reduce the footprint even further.

Tesco

In 2006, Tesco cut its CO₂ emissions by 10% on each case of goods delivered to store and plans to cut this by a further 50% over the next five years. Tesco recycles 71% of waste from stores and aims to increase this to 80% by 2008. Recycling is also a key issue for customers and automated recycling machines, introduced in 2005, sort plastic, metal and glass – so customers don't have to. Tesco has also committed to reducing packaging by 25% by 2010 on both branded and own label products.

Through the Tesco Sustainable Dairy Project (TSDP), Tesco's dedicated and segregated milk pool has identified four pillars of work, which aim to improve efficiencies and reduce cost on farm. One of the key pillars identified by the Project is the Environment, where producers, with the support of Tesco, can assess practices and processes that reduce energy use, and look at greener and renewable sources of energy.

Sainsburys

In October 2006 Sainsbury's announced its intention to work with a group of known producers in order to improve efficiencies in the dairy sector. It announced that they would work closer with dairy farmers in a newly formed "development group" to strengthen links and improve transparency in the supply chain. This initiative was welcomed and endorsed by all including the NFU and DairyCo.

The aims of the Dairy Development Group were to improve communication, efficiency and innovation between Sainsbury's, its processors and its producers through initiatives. Through each initiative, the value added must be greater than the cost

The areas of the initiatives cover –

1. Herd Health and Husbandry
2. Environment and Energy
3. Collaborative working
4. Business improvement

8. The Roadmap Targets

The dairy sector has come a long way in recent years in reducing its environmental impact, achieved by adapting farming practices to deliver environmental and economic benefits. However, it is evident that there is more that can be done. In setting targets for the industry there must be an existing baseline from which performance can be benchmarked, monitored and improved upon. This also requires the ability to accurately measure performance. As set out in the document, there are areas where specific targets and figures can be applied and measured, for example fertiliser usage, nutrient levels, pollution incidents and entry into Environmental Stewardship schemes. However, there remain important areas where measurability of performance is more complicated. At present, there is little or conflicting data available and an absence of a sophisticated methodology for measuring and monitoring environmental performance, the most significant of which being the ability to measure the dairy sector's contribution to GHG emissions.

The targets outlined below are presented with an estimation of the current baseline data (where available), a brief description as to how the target might be achieved, how and if performance can be measured and an acknowledgement of any limitations to achievement.

For the processing sector, the targets refer to the sector as a whole. For all targets flexibility may need to be exercised to take into account the circumstances, including product mix and baseline, at each processing site. The aim of achieving overall reductions in environmental impacts should never be over-ridden by the need to achieve individual targets.

Short Term Actions: by 2010					
Who?	Target	Current Level	How?	Measure	Limitation
Producers	50% of dairy managed farmland entered into Environmental Stewardship Schemes	35% (estimated)	Continued promotion of the scheme and its benefits	Request that Defra records farm type in future ESS data collection	Options available will help/hinder uptake. Natural England are currently examining the ways in which the benefits of management plans might be captured in future
	5- 15% reduction in water usage per litre of milk	Varies per farm. This target reflects the little extra reduction possible	Reducing waste of water and improving efficiency by auditing and	Water auditing results / DairyCo water use survey of Extension	Water usage can only be reduced to levels which do not compromise

		for some of the most efficient producers and a high reduction for people who are not already efficient.	seeking opportunities for water re-use such as rainwater harvesting, use of 'green water'.	Groups	standards of animal welfare standards or hygiene
65% dairy farmers actively nutrient planning	The NFU and AIC are conducting a survey of grassland farmers in summer 2008 to establish a baseline for the number of farmers actively nutrient planning. Under the revised NVZ Action Programme 65% of milk quota is within an NVZ and this forms the basis of the present target for nutrient planning.	Compliance with revised NVZ Action programme and continued development of nutrient planning tools and materials and communication of benefits	Reduced levels of N in watercourses and numbers of farmers with a nutrient management plan	Farmers may be reluctant to adopt nutrient planning unless they can see a direct economic benefit to doing so.	
30 dairy farms piloting on-farm Anaerobic Digestion	Only a small number of case studies are available on dairy farmers who have invested in this technology	Clear communication and information disseminated to farmers about AD, including finance, installation, planning and benefits	Record and collate case studies. Explore potential for industry survey	Huge capital investment required and only currently suited to large dairy units.	
100% dairy farmers, through DairyCo, supporting research into new	Dairy farmers already support and encourage new	R&D has been identified as a clear priority under new	Dairy Co to provide updates to industry on	Competing pressures on DairyCo's budget.	

	technologies	research, funded by farmer levy	Dairy Co Business Plan	latest research developments and trials	
	95% of producers have a manure management plan	Current requirement of Assured Dairy Farm Scheme. Current compliance rate is between 88-90%	Promote the benefits of waste management and ensure total compliance	ADF inspection records and numbers of non-conformances	Data sharing
	95% of producers have Farm Health Plans	Current requirement of Assured Dairy Farm Scheme - not achieved total compliance and/or full utilisation of plans	Promote the benefits of pro-active farm health planning, educate producers and explore performance based outcomes	ADF Inspection records and number of non-compliances	Data sharing, indicators / measurability of health
Processors	All processors will meet or beat energy and CO2 reductions of the sector Climate Change Agreement.				
	Dairy UK will operate an environmental benchmarking and best practice performance programme and will publish an annual sustainability report providing evidence of progress towards targets.				
	A minimum of 10% recycled UK HDPE in milk bottles				
Retailers	All major multiple retailers should establish positive, direct (where appropriate) relationships with producers (farmers) and processors. The objectives of these relationships are to improve transparency in the supply chain, communication and efficiency. Agree initiatives to add value and support the delivery of the targets for producers and processors in the Roadmap.				
	All major retailers should recognise the work of the Roadmap and, where possible, incorporate targets within their own Corporate Responsibility Targets covering points such as carbon emissions, reduction in energy use, reduction in water use and reduction in waste going to landfill (not an exhaustive list)				
	All major retailers should consider the use of technological interventions to reduce CO2 emissions associated with transport of liquid milk				
	Retailers should support supply chain delivery of environmental benefits by reinforcing positive environmental messages for milk through product placement and point of sale information.				

Medium Term Actions: by 2015

Who?	Target	Current Level	How?	Measure	Limitation
Producers	65% of dairy managed farmland entered into Environmental Stewardship Schemes	35% increasing to 50% by 2012 (estimated)	Continued promotion of the scheme and its benefits	Request that Defra records farm type in future ESS data collection	Options available will help/hinder uptake.
	90% of producers have nutrient management plans in place	45% increasing to 65% by 2015 (estimated) with a goal for the majority of producers to be engaged in Nutrient Planning	Compliance with revised NVZ Action programme and continued development of nutrient planning tools and materials and communication of benefits		
	20-30% of producers trialling new technologies to reduce emissions from cattle (including for example improved slurry and manure management, feeding efficiency and techniques, and genetics)	DairyCo currently researching effective ruminant nutrition regimes that reduce the production of Methane and ammonia.	Encouraging farmer participation in trials	Currently, this means approximately 3000 dairy farmers engaging in new technologies. This will be monitored by DairyCo by surveys of 100 dairy discussion groups	Dependent on investment in R&D and advances in feeding technologies as well as impact on dairy cow yields / performance
	Continued declining trend in serious pollution incidents on farm	Reduced by 35% in 2006-7 to lowest ever level	Better management of pollution risks on-farm	Environment Agency Data	
	Dairy farmers encouraged to	No consistent	Retailers working	Retail dedicated	Dependent on

	calculate the carbon footprint of the farm	industry model available at present, although in development	with dedicated producers, rewarding farmers for calculating and reducing their carbon footprints	producer data	incentives for farmers to calculate carbon footprint, greater industry understanding and awareness of carbon footprinting and development of a consistent, industry agreed methodology
Processors	Every major liquid milk processing company will have in place an Environmental Management System (EMS) covering carbon, energy, water, effluent, waste, packaging, with large progressing to an externally certified/verified EMS by this milestone. Dairy UK will encourage small and medium-sized companies to adopt EMS.				
	SMEs investigating environmental management systems				
	Every liquid milk processing site with gas-fired boilers over 2MW will use low NOx burners.				
	All processors will meet or beat energy and CO2 reductions of the sector Climate Change Agreement.				
	All large liquid milk processing sites will carry out benchmarking of Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) discharged per tonne of product.				
	The COD load in discharged effluent will be reduced by 20% at all liquid milk processing sites.				
	Large processors will undertake benchmarking of energy efficiency – CO2 emissions and energy (kWh) relative per tonne of finished product.				
	Dairy UK will work with dairy companies to develop if feasible three fully operational Centralised Anaerobic Digesters at processing sites, with at least one of these being a liquid milk operation.				
	10% of non-transport energy use to come from renewable sources or Combined Heat & Power/Tri-Generation systems for large processors.				
	10% of non-transport energy use to come from renewable sources or Combined Heat & Power/Tri-Generation				
	To send zero ex-factory waste to landfill where environmentally advantageous for all large processing sites.				
	Large processors to achieve an absolute reduction in water use of 20% through increased water reuse and recycling against a 2007 baseline.				
	To achieve an average water use volume to product volume ratio of 0.5 (2007 best practice) at large liquid milk processing sites where environmentally appropriate. Estimated water saving of 4.2 billion litres per year, based on the average ratio for large processing sites of 1.1.				
All large liquid milk sites will implement a carbon management programme (This represents over 90% of production).					
There will be no direct discharges of polluting substances to groundwater.					
Minimum of 30% recycled material in packaging materials					

Retailers	Retailers should look to reduce emissions from existing retail stores – including new refrigeration technology and interventions
	All major retailers should explore options to increase the amount of recyclate used, and encourage recyclability, in product packaging from a 2007 baseline to close the recycling loop. They should also invest in ways to recover materials from their customers to achieve this.

Long Term Actions: by 2020					
Who?	Target	Current Level	How?	Measure	Limitation
Producers	20 - 30% reduction in GHG (carbon equivalents including Co ₂ , CH ₄ , N ₂ O) balance from dairy farms between 1990 and 2020	Methane emissions have fallen by 13.5% since 1990. Carbon emissions have fallen by 23% since 2000 through improved efficiencies at the point of Nitrogen fertiliser production ¹²	New feed technologies, improved yields, greater longevity to reduce culling rates and breeding of replacements	Currently no industry agreed calculation for GHGs. This figure builds on current performance and is in line with international Kyoto targets	Currently, only those mitigation methods that involve a reduction in number of animals register as a reduction on the enteric fermentation inventory. A more inclusive and comprehensive inventory calculation is required.
	70% of non-natural waste is recycled or recovered as standard practice	Aspirational target subject to change following publication of Producer Responsibility targets and following a review of progress before 2020.	Through compliance with Agricultural Waste Regs and enabled by the introduction of Producer Responsibility Scheme	Compliance with PR scheme and Waste Regulations – Defra monitored	Lack of suitable recycling infrastructure and certain types of material (e.g. fertiliser and feed/seed bags, veterinary medicines and animal health products, baler twine & net wrap) are not

¹² British Survey of Fertiliser Practice Survey 1995-2005

					recyclable and have to be sent to land fill.
	40% of energy used on dairy farms is from renewable sources	This is in line with the Government's commitment to generate 11-15% of the UK's energy from renewable sources, as a contribution to an EU target of 20%.	Generation of energy on farm through Combined Heat and Power installations, Anaerobic Digesters.	Government performance targets on Renewable Energy and NFU member information	
Processors	To send zero ex-factory waste to landfill.				
	All processors will meet or beat energy and CO2 reductions of the sector Climate Change Agreement.				
	Large processors will achieve an absolute reduction in water use of 30% through increased water reuse and recycling against a 2007 baseline (small processors to achieve a 20% reduction).				
	50% recycled material will be used in packaging materials				
	All tertiary packaging is to be re-usable or recyclable				
	Dairy UK will work with dairy companies to extend where feasible Centralised Anaerobic Digesters at processing sites.				
	Environmental management systems will be in operation at all sites				
	SMEs will be achieving the medium term targets				
	Processors will reduce transport emissions per litre of milk by optimisation of vehicles and transport routes.				
	Dairy UK will be publishing environmental management reports giving the environmental performance for the whole dairy sector.				
	10% of non-transport energy use to come from renewable sources or Combined Heat & Power/Tri-Generation systems for all processors.				
	All liquid milk processing sites will implement a carbon management programme.				
	All processors to undertake benchmarking of energy efficiency in terms of CO ₂ emissions and energy (kWh) relative per tonne of finished product.				
	All liquid milk processing sites will carry out benchmarking of Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) discharged per tonne of product.				
	The COD load in discharged effluent will be reduced by 20% at all liquid milk processing sites.				
	To achieve an average water use volume to product volume ratio of 0.5 at liquid milk processing sites where environmentally appropriate. Note that the 0.5 ratio is the best performance of a processor as determined by				

	benchmarking in 2007, with the industry average for all processors approximately 1.3. This would provide a saving of approximately 5.6 billion litres of water per year.
Retailers	Retailers should make visible commitments to support environmental achievements by their suppliers
	Retailers should make a commitment that all new stores built between now and 2020 will emit less carbon than an equivalent store in 2006.

9. Government supporting actions for the Roadmap

Encouraging wide scale take up of environmental improvement measures amongst dairy farmers

Defra is providing £250k up to March 2009 to support the Farming Futures project. Farming Futures is run by Forum for the Future, in partnership with the NFU, the CLA, the AIC and the Agriculture and Horticulture Research Forum (representing all six statutory and two voluntary agriculture and horticultural levy boards). It provides advice and information to farmers about the risks, responsibilities and opportunities of climate change, and their role in mitigating greenhouse gas emissions and adapting to a changing climate. The project has produced a number of sector specific fact sheets (including one for the dairy industry) and is currently developing advice on topics such as anaerobic digestion, biomass, and water management. This year the project will also be running a number of regional and sector specific workshops on climate change. For more details see www.farmingfutures.org.uk.

Defra is also continuing to work closely with the Rural Climate Change Forum - their high level stakeholder advisory body, which advises on policy, research and communications issues for climate change and land management. The Forum's work includes building a better understanding of measures that farmers can take to reduce their greenhouse gas emissions and support broader climate change objectives. The Forum carried out a review of relevant research last year in order to identify the priority good practice actions that farmers can take. These are being communicated through the Farming Futures project.

Provide support through investment in sustainable energy projects and infrastructure

Through the Environmental Transformation Fund Defra will invest around £10 million to help build a number of commercial-scale anaerobic digestion demonstration plants.

Defra will be making resources available from the Environmental Transformation Fund to enable the Carbon Trust to expand its successful innovation activities (as part of this the Carbon Trust is working on a major research project aiming at speeding up the development of second generation bio-fuel technologies).

The Bio-energy Capital Grants Scheme supports the installation of biomass-fuelled heat and combined heat and power plants, including anaerobic digestion, in the industrial, commercial and community sectors. The fourth round of the scheme was launched on 9 April 2008 with a 6 week application window up to 20 May. Full details are available at: <http://www.bioenergycapitalgrants.org.uk>. Subject to funds being available, Defra hopes to run a further application round in autumn 2008, with several more rounds in 2009 and 2010.

The Bio-energy Infrastructure Scheme supports farmers, foresters and businesses to set up supply chains to provide biomass fuel for heat and electricity end users, including own-use. The scheme is currently closed to applications but an announcement is expected in Spring 2008 on the details of a further funding round.

Developing a standard carbon methodology

Defra acknowledges that an accepted methodology for footprinting greenhouse gases is critical. That is why a standard methodology for measuring carbon is being developed by BSI, with Defra and the Carbon Trust. Defra recognise that this methodology will not be available in the short-term, and in the interim are encouraging producers to use other industry developed tools to help them examine and understand the environmental impacts of the business.

Considering ways of supporting change through a review of planning restrictions on new infrastructure with environmental benefits

Communities and Local Government (CLG) are currently undertaking a number of reforms of the planning system. These include a review of permitted development rights for non-domestic microgeneration equipment to make it easier for businesses (including farm businesses) to install microgeneration equipment without planning permission. A review of wider non-domestic permitted development rights is also underway, and is looking specifically at permitted development rights farm businesses, including the possibility of removing the need for planning permission for small on-farm incinerators and biomass boilers. CLG will consult on proposals to extend permitted development rights later this year, and we would encourage dairy sector stakeholders to feed into this process.

Reviewing accessibility of ESS schemes to dairy farmers, and review options for nutrient management plans for ELS

The Environmental Stewardship Review of Progress has recommended a range of changes to the scheme in respect of advice, promotion and support. The evaluation report by Central Science Laboratory can be found at:

<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=13825#Description>

Natural England is developing a strategy to ensure appropriate take up of HLS by expiring ESA/CSS agreement holders. NE will be pro-active in securing HLS agreements that will achieve their priority outcomes. Those not appropriate for HLS will be offered ELS agreements.

Defra understand that there is some concern about the removal of Management plan options. These, in their previous form, will not be reintroduced; however Defra and Natural England are working closely with farming representatives to see if they can build on the benefits of management plans by developing new or amended options which might offer better value for money above the regulatory baseline.

Reviewing best practice for water recycling techniques/technologies

Defra encourage dialogue between parties in the dairy supply chain to ensure that regulatory requirements are clear, and to ensure that there are no unnecessary barriers to the use of recovered water. Defra are happy to be involved in working to overcome any perceived barriers to reuse and recycling where food specifications are used that do not allow the use of recycled water.

10. The Review and Monitoring Process

To ensure that the Milk Roadmap is a credible expression of the industry's commitment of working to improve the environment, mechanisms are being put in place to monitor compliance by the industry in meeting the targets set out in the Roadmap and to ensure that this performance is subject to public scrutiny. The Roadmap document and targets will also be kept under review.

Annex 1 - Further Industry Initiatives Delivering Environmental Improvement on Dairy Farms

MANNER: A decision support system that can be used to accurately predict the fertiliser nitrogen value of organic manures on a field specific basis.

Defra CSF initiative: Some 1200 applications for the CSF capital grant fund were submitted, totalling some £8M, which exceeded the £5M budget. Dairy received approximately 37% of the £5M budget. This shows the strong engagement of the dairy sector in voluntary schemes to reduce diffuse pollution from agriculture.

DairyCo Initiatives

grass+: Over 2000 dairy farmers utilise this resource which is designed to reduce the costs of milk production through grass and environmental management best practice. These folders are regularly updated to include the latest worldwide research outcomes.

Environmental Packages for Dairy Farm Discussion Groups: Produced by DairyCo for groups of farmers to use as learning resources that involve visual and electronic materials to aid understanding in the environmental arena.

Ruminant Nutrition Regimes to Reduce Methane and Nitrogen Emissions: A review of current knowledge and recommendations for implementation of effective ruminant nutrition regimes that reduce the production of Methane and ammonia. This research will feed directly into a more detailed project that will identify specific dietary regimes for dairy production.

Economic Strategies to Increase Slurry Storage Capacity Efficiently: To outline the practical and cost effective methods to increase slurry storage capacity for individual dairy farm situations. This project will be combined with other DairyCo and industry initiatives as part of the whole manure management plan concept.

Reducing Heifer Wastage in the Dairy Herd (co funded with Defra): An ongoing project to monitor cows through their first three lactations and to determine the relative importance of genetic and environmental components during the rearing period in relation to subsequent cow fertility and longevity.

Impacts of Biofuel Production on Dairy Feeding: A desktop review to appreciate the dairy cow feed impacts as a result of increasing production of this evolving market. This will link directly to feed efficiency work being undertaken by the DairyCo for the sector.

NIRS test for Farm Yard Manure (LINK): To develop a rapid, reliable analysis system for farm yard manures. The developed techniques should make a significant contribution towards improved recycling of organic residues in farming with reduced environmental emissions.

Annex II - Glossary of Terms

Agricultural Waste Regulations	Regulations to manage waste produced on farm
AIC	Agricultural Industries Confederation
Anaerobic Digestion	Process in which microorganisms break down biodegradable material in the absence of oxygen, producing predominantly methane gas, which can be used as a fuel, and a digestate that can be used as a fertilizer.
Assured Dairy Farms	Farms under the National Dairy Farm Assured Scheme (NDFAS) that follow guidelines and meet that standards set on the production methods and the safety and quality of milk leaving the premises
BAP	Biodiversity Action Plan
BCVA	British Cattle Veterinary Association
Biochemical Oxygen Demand (BOD)	A measure of the amount of oxygen consumed by micro-organisms in breaking down a pollutant (usually in water or waste water)
Biofuels	Fuel derived from a plant or animal origin
Biomass boilers	Boilers that use 'biomass' (organic matter of recent origin) rather than fossil fuels.
CAP	Common Agricultural Policy
Cattle Health Initiative (CHI)	One of four linked Cattle Health Planning Projects which provides health planning services to 100 dairy and 100 beef farms across England
Chemical Oxygen Demand (COD)	A measure of the oxygen-consuming capacity of both inorganic and organic matter (usually pollutants) present in water or wastewater.
CLA	Country, Land and Business Association
Cleaning in Place (CIP)	System designed for automatic cleaning and disinfection without major disassembly and assembly work
Climate Change Agreement (CCA)	Agreement which allows certain business users to receive a discount from the Climate Change Levy in return for meeting energy efficiency or carbon saving targets.
CSR	Corporate Social Responsibility
Dairy Supply Chain Forum (DSCF)	Established in July 2002 to help address some of the issues affecting the dairy sector raised by Sir Don Curry's Policy Commission. For further information: http://www.defra.gov.uk/foodrin/milk/documents/dscf-2003-2007.pdf
DairyCo	Milk Development Council before 1 April 2008
Dairy UK	Trade organisation representing processors and distributors of liquid milk and dairy products

	and milk producer co-operatives
Defra	Department for Environment, Food and Rural Affairs
Digestate	Solid material remaining after the anaerobic digestion of a biodegradable feedstock
EA	Environment Agency
EBLEX	English Beef and Lamb Executive
ECHAWG	English Cattle Health and Welfare Working Group
ELS	Entry Level Schemes
EMS	Environmental Management System
Enteric Fermentation	Fermentation in the digestive systems of ruminant animals
Environmental Plan for Dairy Farming	Joint industry Government initiative that encourages dairy farmers and their advisers to adopt straightforward approaches to reducing the environmental impact of dairy farming. The stakeholders involved are National Farmers Union, Dairy Co, Environment Agency, Dairy UK, Royal Association of British Dairy Farmers, natural England and Welsh Assembly Government
ESA	Environmentally Sensitive Areas
FACTS	Fertiliser Advisers Certification and Training Scheme
Farm Health Planning	Industry led initiative funded by Defra and part of the GB wide Animal Health and Welfare Strategy
FAWC	Farm Animal Welfare Council
FWAG	Farming and Wildlife Advisory Group
Grass +	Online resource designed to reduce the costs of milk production through grass and environmental management best practice.
Greenhouse Gas Balance	A GHG Balance takes account of the emissions debits and credits from farming systems. Debits include emissions from manures, livestock and energy used in buildings, field operations and transport. Credits include the generation of renewable energy, the energy offset against other products from the farm such as calves and cull cows and reduction in emissions from enhanced energy and feed efficiency. This methodology enables farmers to reduce their overall emissions balance, while maintaining the flexibility to increase the size of their herd and farm business.
Greenhouse Gases (GHG)	Gases that come from both natural sources and human activity and contribute to the Greenhouse Effect (by trapping the Earth's heat in the atmosphere) – water vapour, carbon dioxide, methane, nitrous oxide, ozone and CFCs.
HDPE	High Density Polyethylene
IGD	Provides food and grocery information, insight and best practice
IPPC	Regulatory system to control the environmental impacts of certain industrial activities through

	a single permit process.
ISO14001	International specification for an independently certified environmental management system
K	Potassium
Kyoto	Protocol to the International Framework Convention on Climate Change with the overall aim of reducing greenhouse gases
LEAF	Organisation "Linking Environment and Farming"
Life-Cycle Analysis (LCA)	An investigation into the impacts from a material or product carried out by examining the complete and progressive stages in its origin, processes it goes through, and its final state.
MDC	Milk Development Council (DairyCo as of 1 April 2008)
Methane	Colourless, odourless gas commonly used as a fuel (natural gas). It is one of the basket of greenhouse gases (along with carbon dioxide and nitrous oxide)
Milk Quotas	Limits on milk production by Member State, administered by the European Union.
MLC	Meat and Livestock Commission
N	Nitrogen
NFU	National Farmers' Union
NIRS	Nuclear Information Resource Service
Nitrous Oxide	Colourless non-flammable greenhouse gas
NVZ	Nitrate Vulnerable Zone/s
P	Phosphorus
PAS 2050	Publicly Available Specification for developing a standard Carbon methodology being jointly developed by Defra and the Carbon Trust
rHDPE	Recycled High Density Polyethylene
River Basin Management Plans	Required under the Water Framework Directive to summarise how the River Basin District will be managed over the plan period (includes measures for delivering environmental improvements)
Roadmap	A Roadmap uses life cycle analysis to complete a 'cradle to grave' picture of the environmental impacts for a product and highlight areas where efforts can effectively be concentrated to reduce those impacts.
Royal Association of British Dairy Farmers (RABDF)	Independent, specialist sectoral body dedicated to representing the interests of practical British dairy farmers
Rumen	A ruminant animal (cattle or sheep) has 4 stomachs the largest of which is the rumen which allows for cellulose to be broken down by bacteria
SPS	Single Payment Scheme
Tallow	Rendered form of beef or mutton fat

Tenant Farmers' Association (TFA)	Organisation dedicated to the agricultural tenanted sector and the authentic voice on behalf of tenant farmers
Volatile Organic Compound (VOC)	Organic chemical compounds that vaporize and enter the atmosphere under normal conditions
Voluntary Modulation	The transfer of funds from farming subsidies in the first pillar of the CAP to Rural Development Schemes
Water Framework Directive	European legislation designed to improve and integrate the way water bodies are managed throughout Europe
WRAP	Waste and Resources Action Programme

Department for Environment, Food and Rural Affairs
Nobel House
17 Smith Square
London SW1P 3JR
Telephone 020 7238 6000
Website: www.defra.gov.uk

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Livestock and Livestock Products Hub
Defra
Area 5B, 9 Millbank
c/o Nobel House
17 Smith Square
London, SW1P 3JR
Email: milk.branch@defra.gsi.gov.uk

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