POSITIVE PROGRESS

An Update on the Roadmap for the environmental sustainability of the English Pig Industry

January 2014
Foreword

When I wrote the Foreword to the English Pig Industry Environment Roadmap ‘Advancing Together’ in April 2011, I expressed confidence that we would meet the targets outlined in that original document. The targets to be achieved by 2020 were ambitious. They challenged our industry to achieve climate change greenhouse gas reductions greater than those the Government had set for the agricultural industries.

It is, therefore, with a great deal of satisfaction but without any complacency, that I can report outstanding progress to date.

Of the improvements we aimed to make by 2020, one (climate change potential) has already been exceeded; a second (eutrophication) has almost been met and we are already more than half way to achieving our goals in the other two categories (acidification and abiotic resource depletion).

This is an outstanding achievement and particularly commendable in the economic climate currently challenging all agricultural sectors.

That said, many of the ways in which we are reducing our impact on the environment also deliver production efficiencies for producers and, ultimately, benefit consumers.

While performance gains in farm productivity have contributed to the success of our Roadmap project, undoubtedly much of the progress achieved to date has been delivered through the high inclusion rates of co-products and by-products from human food production. This is done in a way that produces safe pig feed and safe pork. We have also achieved reductions in overall protein levels in feed as we have sought to reduce the use of imported soya. It is encouraging that while pig producers’ feed costs rocketed due to global commodity price movements, the nutrition scientists within the feed industry have helped contribute so effectively to reducing our environmental footprint.

So I remain confident that the pig industry’s determination to play a full part in reducing the environmental impact of its activity remains undiminished. This report is a snapshot of progress against our original targets and should be read in conjunction with the original Roadmap report. It is also a clear statement that the English pig industry can and will do even more to establish itself as an environmentally friendly meat that everybody can enjoy. We will continue to report on our progress.

Stewart Houston, CBE, FRAgS
Chairman, BPEX
Introduction

With the publication in April 2011 of the Roadmap ‘Advancing Together’, the English pig industry demonstrated its commitment to playing its part in the transition to a low carbon economy, while at the same time continuing to provide safe, quality-assured food of known provenance and to high standards of animal welfare.

Almost three years on, it is time to check the industry’s progress against our stated targets which, as reported at the time, were ambitious but achievable. It is also timely to reassess key priorities to achieve continuing improvement.

The 2011 targets were set in the context of the Government’s imperative for a transition to a Green Economy as proposed in the Low Carbon Transition Plan, the agricultural industries’ Greenhouse Gas Action Plan and the European Commission’s publication ‘A Roadmap for moving to a competitive low carbon economy in 2050’.

Pork consumption in the UK remains stable but in the last 10 years there has been a move to imports as the British industry contracted. Self-sufficiency reduced from 75 per cent to 53 per cent in the period 1995 to 2012. A sustainable industry seeks to change this.

It should also be noted that in embracing the wider concepts of sustainability and reducing the environmental impact of its activity, the pig industry is seeking to derive operational efficiencies that have a direct benefit for producers and consumers.

This report presents the results from an independent life cycle assessment (LCA) made by Environmental Resources Management Limited (ERM) commissioned by BPEX. ERM has used a combination of published and industry-sourced data from the years up to and including 2012. The Report then projects forward to 2020 and assesses further progress that can be delivered.

The first part of our report summarises the reductions in environmental burdens, not just carbon, that the industry achieved during the period 2008 – 2012.

The second part summarises BPEX and industry activity against stated actions within the Roadmap which were considered necessary in order to deliver the reduction targets the industry set itself.

The four environmental impact categories being targeted against which the results are reported are described as follows:

- Climate change potential is an increase in temperature caused by the emission of carbon dioxide (CO2) and other greenhouse gases into the atmosphere. The results are expressed in kg CO2 equivalents and represent a time horizon of 100 years.
- Eutrophication potential is a reflection of the amount of nutrients (eg nitrate and phosphate from manure/slurry) leached to the aquatic environment. Nitrates and phosphates are essential for life but increased concentrations in the aquatic environment can cause excessive growth of algae, reducing the oxygen within the water and damaging ecosystems. The results are expressed in kg phosphate (PO4) equivalents.
- Acidification potential relates to the release of acidic gases (eg ammonia from slurry/manure or sulphur dioxide (SO2) from the combustion of fossil fuels), which have the potential to react with water in the atmosphere to form ‘acid rain’, resulting in reduced pH in natural habitats (eg lakes) and thereby causing ecosystem impairment. The results are expressed in kg SO2 equivalents.
- Abiotic resource depletion potential estimates the extraction of scarce minerals and fossil fuels. An abiotic depletion factor is determined based on the remaining global resource reserves and their rates of de-accumulation. The results are expressed in kg antimony (Sb) equivalents.

Note: Some of the values for the estimated environmental impact of pig production presented in this report are different to those contained in the Roadmap. New calculations were necessary for a number of factors, including changes to accepted Life Cycle Assessment (LCA) methodologies, agreed emission factors and farm recording data points. In addition, the availability of new data from Defra providing a breakdown of the proportion of pigs housed in various systems and specific and detailed feed ration composition data (as opposed to nutritional percentages) meant a more accurate measure of all environmental impacts could be calculated.

All of the data presented in this report, including historical data, has therefore been revised to reflect the updated methodologies. Consequently, the historical emissions are higher than previously reported. Progress in reducing environmental impacts up to 2012 and likely improvements to 2020 have been assessed using the same methodologies.

2 Note: Some of the values for the estimated environmental impact of pig production presented in this report are different to those contained in the Roadmap. New calculations were necessary for a number of factors, including changes to accepted Life Cycle Assessment (LCA) methodologies, agreed emission factors and farm recording data points. In addition, the availability of new data from Defra providing a breakdown of the proportion of pigs housed in various systems and specific and detailed feed ration composition data (as opposed to nutritional percentages) meant a more accurate measure of all environmental impacts could be calculated.

All of the data presented in this report, including historical data, has therefore been revised to reflect the updated methodologies. Consequently, the historical emissions are higher than previously reported. Progress in reducing environmental impacts up to 2012 and likely improvements to 2020 have been assessed using the same methodologies.
Summary

This report presents the results from an independent life cycle assessment (LCA) made by Environmental Resources Management Limited (ERM) commissioned by BPEX. ERM has used a combination of authoritative published and industry-sourced data up to 2012. The Report then projects forward to 2020 and the progress which can be delivered.

In 2009, ERM conducted the baseline LCA of the environmental impact of pig production in the United Kingdom. Targets were then set to reduce this impact, taking into account pig producers’ desire to use resources effectively. These targets and the actions to deliver them were published and used in ‘Advancing Together’.

The objective of the industry is to be a competitive, sustainable supplier of low carbon pork and pork products and to be a part in ensuring that the UK meets its low carbon targets. We are committed to being part of the solution, not the problem.

Two years after the publication of ‘Advancing Together’, the independent assessment from ERM shows a considerable reduction in the environmental impact of pig production.

In particular, the reduction in climate change potential achieved to date (26 per cent) far exceeds the overall 2020 target of 17 per cent. This reduction amounts to 0.8 Mt of CO$_2$-eq in 2012 compared to 2008.

There have also been considerable improvements in eutrophication, acidification and resource depletion four years into a 12-year timeframe.

Although Government has not set targets for eutrophication, acidification and abiotic resource depletion, these remain important issues for the pig industry. These indicators continue to be assessed to ensure that pollution-swapping is avoided and that the best environmental, social and economic outcomes can be delivered.

Progress against these four key environmental impact categories identified in the Roadmap are shown below (Chart 1).

### Chart 1: Comparison of 2008 to 2012 results (per kg of pork)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>kg CO$_2$-eq</td>
<td>6.18</td>
<td>5.93</td>
<td>5.88</td>
<td>4.55</td>
<td>4.55</td>
</tr>
<tr>
<td></td>
<td>% change p.a.</td>
<td>4.0%</td>
<td>0.9%</td>
<td>22.6%</td>
<td>0.0%</td>
<td>26.3%</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>kg PO$_4$-eq</td>
<td>0.072</td>
<td>0.069</td>
<td>0.068</td>
<td>0.063</td>
<td>0.059</td>
</tr>
<tr>
<td></td>
<td>% change p.a.</td>
<td>3.6%</td>
<td>1.8%</td>
<td>7.3%</td>
<td>1.0%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Acidification</td>
<td>kg SO$_2$-eq</td>
<td>0.207</td>
<td>0.201</td>
<td>0.198</td>
<td>0.191</td>
<td>0.187</td>
</tr>
<tr>
<td></td>
<td>% change p.a.</td>
<td>2.7%</td>
<td>1.5%</td>
<td>3.7%</td>
<td>1.8%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Resource depletion</td>
<td>kg Sb-eq</td>
<td>0.0090</td>
<td>0.0086</td>
<td>0.0085</td>
<td>0.0083</td>
<td>0.0083</td>
</tr>
<tr>
<td></td>
<td>% change p.a.</td>
<td>4.4%</td>
<td>1.5%</td>
<td>2.6%</td>
<td>0.0%</td>
<td>8.3%</td>
</tr>
</tbody>
</table>

Analysis of targets for the current period 2008-2012

- Climate change – reduction of 26 per cent against a target of 17 per cent. 
  Target exceeded by 65 per cent.

- Eutrophication – reduction of 13 per cent against a target of 15 per cent. 
  Target nearly achieved.

- Acidification – reduction of 9 per cent against a target of 15 per cent. 
  Target over 50 per cent achieved.

- Resource depletion – reduction of 8 per cent against a target of 16 per cent. 
  Target 50 per cent achieved.

Key factors contributing to this improvement

1. The quantity and composition for pig feed per kilogram of pork produced. 
   Between 2008 and 2012 the climate change impact reduced by 34 per cent from 4.45kg CO$_2$-eq to 2.92kg CO$_2$-eq. This is a result of:
   a. Increased inclusion rates of food and drink industry co-products in rations to above 40 per cent.
   b. Soya use has been cut by 50 per cent and is down to around 8 per cent.
   c. Reduced protein content in feed as a result of applying feed technology and research outcomes.
   d. Improved feed utilisation through better farm practice and management.

2. The breeding herd life cycle stage delivered improvement in climate change and resource depletion impact categories of 37 and 24 per cent respectively. This was the greatest of the farm production stages. This is a result of:
   a. Total feed per sow reducing by 250kg per year from better management.
   b. Bigger litter sizes and the number of piglets per sow per year increasing by 1.8.
   c. Slightly heavier piglets at weaning.

3. The finishing herd production stage reduced by 24 per cent its climate change impact. Modest improvements of 10, 6 and 6 per cent were made in eutrophication, acidification and resource depletion respectively. These are a result of:
   a. Changes in the composition and quality of feed. This remains the most important contributor to environmental impact.
   b. Better feed conversion and daily gain.
   c. Reduced mortality.
   d. Higher carcase weights (0.5kg).

4. Small incremental improvements across all parts of pig production:
   a. Housing; reduced emissions of gases to air, which in the case of methane, comes from enteric fermentation within the actual pig.
   b. Electricity; improved use efficiency.
   c. Slurry and manure, an improved application and use as a crop fertiliser and lower gaseous emissions resulting from improved feed use.

In the following chapter, this report checks Roadmap commitments against actions and delivery. There has been good and steady progress in all areas. These results show that the programmes of activity identified within ‘Advancing Together’, are being developed and delivered by the industry. Pig producers are focused on improvement in productivity while maintaining high standards of animal welfare. As a result they have delivered considerable progress towards supplying customers with sustainable low carbon pork and pork products.

$^4$ To ensure the assessments are valid, new and historic data was revised and made comparable. This is of particular importance in relation to the application of International Panel for Climate Change (IPCC) LCA methodology and emission factors. Land use change has been applied to feed ingredients, of most importance to soya products.
Going forward to 2020

Looking forward, we believe that pig producers in this country can and will deliver further reductions in environmental impact, despite the fact that targets have already been exceeded or look likely to be exceeded by 2020 (Chart 2). This will be an important contribution when global population is increasing, as is the demand for resources including land and water.

English pig producers will continue to use valuable resources such as feed in a more efficient way. Food and drink manufacturers see the animal feed market as adding value to their businesses. This is likely to increase as pig feed is a much more efficient and environmentally friendly alternative to disposal. British pigs already eat more than 1 million tonnes of non-meat co-products produced in a safe and sustainable way.

World demand for vegetable proteins, including soy, will continue to grow, particularly in Asia. This will drive feed manufacturers to make more efficient use of soya and to seek alternative sources of vegetable protein for pig feed. Monitoring progress of our competitors, especially those in Denmark and the Netherlands, shows the levels of performance which breeding, science and skill can deliver. As long as they remain ahead, our producers will seek to emulate their success.

Engagement and participation in activities such as training, pig health improvement, knowledge transfer and the desire to invest in better pig buildings gives a clear indication that there is momentum for change.

Risk remains, with new pig diseases and volatile market price being the main threats. These will need to be monitored and managed.

The pace of improvement will slow, which is not unexpected following such significant early gains.

Finishing herd physical performance is currently on par with leading European countries and so limited improvement across the key environmental impacts (between 2 and 8 per cent) is expected.

The rearing herd performance is expected to continue to improve and so reduce all of its impacts by nearly 40 per cent, closely followed by replacement sows, at around 30 per cent. Currently these are focus areas for BPEX and the pig producers we work with.

<table>
<thead>
<tr>
<th>Impact category</th>
<th>Unit</th>
<th>2012</th>
<th>2020 forecast</th>
<th>% improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>kg CO₂-eq</td>
<td>4.55</td>
<td>4.12</td>
<td>10%</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>kg PO₄-eq</td>
<td>0.062</td>
<td>0.059</td>
<td>6%</td>
</tr>
<tr>
<td>Acidification</td>
<td>kg SO₂-eq</td>
<td>0.187</td>
<td>0.180</td>
<td>4%</td>
</tr>
<tr>
<td>Resource depletion</td>
<td>kg Sb-eq</td>
<td>0.008</td>
<td>0.007</td>
<td>11%</td>
</tr>
</tbody>
</table>

Source: ERM LCA
Overall progress 2008-2020

If these further improvements are delivered by 2020, the English pig production industry will have exceeded the targets for reduction of environmental impacts set in the Roadmap of 2011 (Chart 3).

These forecasts show that pollution swapping will not occur and that we will be better placed to deal with challenges such as legislation for tackling phosphate and ammonia pollutions, as well as that already in place for greenhouse gases and nitrogen in water.

A reduction in climate change impact of 33 per cent is double our target and three times that set by government for agriculture.

Conclusion

This report shows that the English pig production industry is making significant progress to meet and, in important areas such as Climate Change Impact, exceed the targets set by Government, the EU and the industry itself. This has been achieved through the more efficient use of valuable resources and the increasing replacement of imported feed ingredients with domestically produced feed, including co-products.

Indications are that further progress can be made. BPEX will continue to work in partnership on activities identified in the 2011 Roadmap to ensure this potential is delivered.

Chart 3: Comparison of 2008, 2012 and 2020 results – per kg of pork

<table>
<thead>
<tr>
<th>Impact category</th>
<th>Unit</th>
<th>2008</th>
<th>2012</th>
<th>2020</th>
<th>% improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>kg CO₂-eq</td>
<td>6.18</td>
<td>4.55</td>
<td>4.12</td>
<td>33%</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>kg PO₄-eq</td>
<td>0.072</td>
<td>0.062</td>
<td>0.059</td>
<td>18%</td>
</tr>
<tr>
<td>Acidification</td>
<td>kg SO₂-eq</td>
<td>0.207</td>
<td>0.187</td>
<td>0.180</td>
<td>13%</td>
</tr>
<tr>
<td>Resource depletion</td>
<td>kg Sb -eq</td>
<td>0.0090</td>
<td>0.0083</td>
<td>0.0074</td>
<td>19%</td>
</tr>
</tbody>
</table>

Source: ERM LCA

The four environmental impact categories being targeted against which the results are reported are described as follows:

- **Climate change potential** is an increase in temperature caused by the emission of carbon dioxide (CO₂) and other greenhouse gases into the atmosphere. The results are expressed in kg CO₂ equivalents and represent a time horizon of 100 years.

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- **Acidification potential** relates to the release of acidic gases (eg ammonia from slurry/manure or sulphur dioxide (SO₂) from the combustion of fossil fuels), which have the potential to react with water in the atmosphere to form ‘acid rain’, resulting in reduced pH in natural habitats (eg lakes) and thereby causing ecosystem impairment. The results are expressed in kg SO₂ equivalents.

- **Abiotic resource depletion potential** estimates the extraction of scarce minerals and fossil fuels. An abiotic depletion factor is determined based on the remaining global resource reserves and their rates of deaccumulation. The results are expressed in kg antimony (Sb) equivalents.
The Roadmap Journey: Assessment of Progress

In this section of the Report we assess progress against targets and objectives stated in ‘Advancing Together’.

The BPEX Roadmap targets

To provide Roadmap objectivity, clear targets for reductions in the environmental burdens of most direct consequence to the pig industry were established and clearly set out in ‘Advancing Together’: climate change, eutrophication, acidification and abiotic resource depletion (Chart 4). The targets were developed from key performance indicators of farm productivity. Projected targets reflect progress in genetic and productivity improvements necessary for the industry to remain competitive in a global market place.

While the target for climate change potential reduction from 2008 to 2020 of 17 per cent is greater than the 11 per cent asked for by Government, the pig industry felt this more ambitious target was achievable when placed against performance over the preceding years. It would not only enable the industry to compete more effectively in a world against other meats, most notably poultry, it also places us in a better position to achieve continued progress post 2020 when targets may be smaller but harder to achieve.

Cradle to farm gate was considered to be the area where the largest improvements could be achieved and where BPEX could effectively collaborate with other industry organisations to influence change.

From cradle to grave (post consumption) pig farming accounted for 72% of the carbon footprint (climate change potential) of British Pork (see Chart 5).

Chart 4: Roadmap targets

<table>
<thead>
<tr>
<th>Impact category</th>
<th>Unit</th>
<th>2001-2008 % improvement</th>
<th>2008-2020 forecast improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>kg CO₂-eq</td>
<td>8%</td>
<td>17%</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>kg PO₄-eq</td>
<td>16%</td>
<td>15%</td>
</tr>
<tr>
<td>Acidification</td>
<td>kg SO₂-eq</td>
<td>17%</td>
<td>15%</td>
</tr>
<tr>
<td>Abiotic resource depletion</td>
<td>kg Sb -eq</td>
<td>7%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Roadmap targets set in 2011 for pig farming (cradle to farm gate)

Chart 5: Climate change potential of pork through its life cycle

- Production stage
- In-home storage and consumption
- Transport, processing, distribution

Source: Environmental Resources Management Ltd, for BPEX 2009.

Definitions: Cradle to farm gate – from creation to the point of sale from the farm.
Cradle to grave – from the point of creation to point of disposal.
The UK is not self-sufficient in pig meat production (circa 40% excluding exports). Retailers and food service operators are heavily dependent upon imports (see Chart 6). Thus, a sustainable solution for the English pig industry lies in increasing output with better resource efficiency rather than in necessarily increasing the national sow herd. This has the double benefit of improving UK resilience in food supply and being better able to influence and control the production of the food we eat and our impact on our planet.

‘Advancing Together’ identified improved productivity and resource use efficiency as the means to deliver improved sustainability. Achieving better economic performance and environmental performance are wholly compatible, thus providing an incentive for engagement and improvement by pig farmers. It was also important to ensure that better performance in one area, eg climate change potential (carbon footprint), did not result in the opposite occurring elsewhere (pollution swapping).

The Roadmap recognised that there is no one magic bullet: almost every aspect of production is directly related to all other aspects. An integrated approach was required. A number of initiatives were already in place and identified as delivery mechanisms, including, for example, Two Tonne Sow, 20:20 Pig Health and Welfare Strategy, Pig Industry Professional Register (PIPR) and collaborative work developing export markets. This integrated approach is graphically illustrated in the diagram below (Chart 7).
Results

In 2009, independent consultants, Environmental Resources Management Limited (ERM) conducted the baseline LCA used to calculate target reductions against productivity-related key performance indicators felt necessary for the industry to be competitive in a global market with the resource demands of increased population and consequences of climate change. These are the targets used in ‘Advancing Together’.

ERM made a further life cycle assessment (LCA) commissioned by BPEX, taking authoritative data from the years up to and including 2012 and then projected forward to 2020 and the further progress possible (Chart 8). These results show the considerable progress, well ahead of target, made to date and continued improvement going forward.

The composition and nutritional quality of pig feed delivered the greatest single contribution to the reduction in climate change potential. This is not totally unexpected as volatility and high commodity prices in 2010 caused feed compounders and nutritionists working directly with farmers to find new sources of proteins in particular, resulting in a move away from soya bean meal to food co-products and by-products.

Chart 8: Comparison of 2008, 2012 and 2020 results – per kg of pork

<table>
<thead>
<tr>
<th>Impact category</th>
<th>Unit</th>
<th>2008</th>
<th>2012</th>
<th>2020</th>
<th>% improvement</th>
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<td>0.059</td>
<td>18%</td>
</tr>
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<td>Acidification</td>
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<td>0.207</td>
<td>0.187</td>
<td>0.180</td>
<td>13%</td>
</tr>
<tr>
<td>Resource depletion</td>
<td>kg Sb-eq</td>
<td>0.0090</td>
<td>0.0083</td>
<td>0.0074</td>
<td>19%</td>
</tr>
</tbody>
</table>

Source: ERM LCA

In compiling the figures used in this table, farm production data was again provided by the Agricultural and Horticultural Development Board’s (AHDB) Market Intelligence division. This data is considered to be the most up-to-date and authoritative data base available, being compiled from farm records for commercial units across the country and covering all production systems.

Life Cycle Assessment methodology was again used to evaluate progress to January 2013.

Defra Farm Practice Survey 2009 results were used to allocate the proportions of the English pig herd to production practice, based on housing type and production system (indoors/outdoors).

Feed composition data for all the main rations employed was provided by feed compounders, the level of detail being much greater than previously available. The original calculations were based on nutritional composition, ie percentage protein, etc, rather than on component inclusion rates, which have been used in this Update report. This allows a better and more precise assessment to be made, reflecting the importance this part of the industry places on improving sustainability and ensuring the competitiveness of its customers.

The environmental impact of pig feed was estimated by applying environmental emission factors sourced from ecoinvent® and the Danish LCA Food Database.

1 LCA of British Pork, Final Report ERM August 21013.
While pig feed has contributed most to the overall reduction in climate change potential, each of the other key inputs to the life cycle carbon footprint of the pig industry has made a positive contribution (Chart 9).

Improvements were also achieved in the other areas of housing, electricity and slurry/manure but to a lesser extent. The broad comprehensive and integrated scope of ‘Advancing Together’ enables multiple gains from actions to be delivered without compromise elsewhere.

**Chart 9: Contribution of key contributors to climate change**

Feed protein

Roadmap Objective: Alternative protein supplies, including home grown pulses, processed animal protein and recovered catering products are being assessed, researched and results disseminated for informed decision making.

NPA analysis of pig feed constituent ingredients

The pig feed industry is divided into three sectors: compound feed, dry home mixed feed and liquid feed. In 2013, a total of 1.228 million tonnes of by-products were used, which accounted for 43.9% of the total pig feed produced.

A recent analysis of the constituent ingredients for UK pig feed by the NPA’s Allied Industry Group shows the percentage market share, total feed and by-product usage for each of these sectors (Chart 10).

**Chart 10: By-product inclusion and total feed usage for the compound, home mixed and liquid feed sectors**

<table>
<thead>
<tr>
<th>Feed type</th>
<th>Percentage of market (%)</th>
<th>By-product usage (000 tonnes)</th>
<th>Total feed (000* tonnes)</th>
<th>% Co-product inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dry Liquid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compound</td>
<td>60</td>
<td>697</td>
<td>1,700</td>
<td>41</td>
</tr>
<tr>
<td>Home mixed</td>
<td>20</td>
<td>230</td>
<td>560</td>
<td>41</td>
</tr>
<tr>
<td>Liquid</td>
<td>20</td>
<td>230</td>
<td>71.25*</td>
<td>53.7</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>1,228</td>
<td>2,800</td>
<td>43.9</td>
</tr>
</tbody>
</table>

*Assuming a 15% dry matter (475,000 tonnes fresh weight basis)
The overall inclusion rate of co-products and by-products from food and alcohol manufacturing sectors now amount to 44% of the UK pig feed.

**Compound pig feed**

1.7 million tonnes of compound pig feed was produced from July 2012 to August 2013 (Defra, 2013). This accounts for approximately 60% of the total pig feed produced.

Approximately 697,000 tonnes were by-products (Chart 11): 41% of the total compound feed manufactured. Soya usage was 10% and cereal usage was 40%. The remaining 9 per cent is made up of other ingredients including pulses, minerals, vitamins, oils and fats, synthetic amino acids and fish meal.

**Chart 11: Weight of by-products in compound pig feed**

<table>
<thead>
<tr>
<th>By-product</th>
<th>Tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rape meal</td>
<td>204,000</td>
</tr>
<tr>
<td>Wheat feed</td>
<td>204,000</td>
</tr>
<tr>
<td>Biscuit meal</td>
<td>170,000</td>
</tr>
<tr>
<td>Distillers grains</td>
<td>85,000</td>
</tr>
<tr>
<td>Molasses</td>
<td>34,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>697,000</strong></td>
</tr>
</tbody>
</table>

**Home mixed pig feed**

Home mixed feed accounts for approximately 20% of the total pig feed produced, at 0.56 million tonnes annually. By-product usage in these diets is estimated to be similar to that of compound diets at 41%. Therefore, 229,600 tonnes of co-products were used.

**Liquid feeding**

Liquid feed also accounts for approximately 20% of the total feed produced using 0.56 million tonne annually. 0.475 million tonnes of liquid by-products were fed at 15% dry matter (equivalent to 71,250 tonnes dry feed). Other dry feed by-products were also included, which is assumed to be 41%. Therefore, total by-product inclusion on a dry matter basis is 300,850 tonnes (53.7%).

**Feed protein content**

The second major change in feed formulation is the reduction in the total crude protein content of major diets. This was initiated by higher costs of vegetable and cereal-based proteins on the world market, making supplementary amino acids (enzymes) a more cost-effective alternative to traditional rates of protein inclusion.

These ingredients improve the accessibility of proteins within the feed, enabling the pig to meet its metabolisable needs from a lower total protein intake in a nutritionally-balanced ration (precision protein).

A collaborative research programme into low-protein diets for pig production provided evidence to confirm that protein in precision-formulated finisher pig rations could be reduced without negatively impacting performance.º

The published results and knowledge transfer information from the Defra LINK Greenpig Project on the sustainable use of home-grown proteins, received considerable coverage in the scientific and general agricultural trade press and interest from pig farmers has been encouragingly widespread.

There is a secondary benefit from the change to feed formulation – the reduced excretion of nitrogen-containing compounds. While slightly reducing the nitrogen fertiliser replacement capability of manures and slurries, pollutants, ammonia and nitrates are also reduced, contributing to the downward trends in both climate change and acidification potentials.

**Bioethanol co-products**

The emerging UK wheat based bioethanol industry had a difficult start, with plant shut-downs and delays before reaching full production. The Dried Distillers Grains with Solubles (DDGS) co-product, has, as anticipated, found a ready use in animal feeds including that for pigs.

Recently, trials at the University of Illinois (as part of the Defra LINK Programme project Environmental and Nutritional Benefits of Bioethanol Co-products - ENBBIO) have included the investigation of the nutritional characteristics of wheat-based DDGS as produced in the UK, as opposed to maize-derived product found in the US and other parts of Europe. This new knowledge is underpinning diet formulations in further small and commercial scale trials as the next stage of this project at Nottingham and Harper Adams Universities.

º Defra Science and Research Projects: Low protein diets for pig production – LK0689
Catering waste and processed animal protein

The use of catering waste and processed animal protein (PAP) remain prohibited as livestock feeds within the EU. This places UK production on a level playing field with other Member state producers. The industry is actively participating in the debate over their use but remains concerned about the ability of robust controls to protect against diseases such as foot and mouth. Maintaining customer confidence is at the forefront of this debate, a disease outbreak can result in loss of exports and sales so have a devastating effect across the supply chain.

Soya bean meal

**Roadmap Objective:** Reducing dependency on imported soya will be encouraged. The transition to RTRS (Round Table on Responsible Soy) is supported.

The pig industry is proactively seeking and adopting alternatives to soy products. Soya bean meal is now considered to make up no more than 10 per cent of the total quantity of pig feed used in the UK; indeed, some industry commentators believe it may be only 8 per cent. The higher levels of use are in weaner and grower diets; finisher diets, which make up the largest tonnage, contain a much smaller proportion, reducing the overall average to between 8 and 10 per cent.

It has not been possible to identify specific data for the origin of soya bean meal and soy oil included within pig rations. Import data for soya beans and soya bean meal does not identify destination for use. The information available indicates an increased reliance on Brazilian product, to the exclusion of US imports (see Chart 12). Inclusion has reduced by approximately 50% over the past 10 years.

The English Pig Industry, through the Feed Materials Assurance Scheme (FEMAS), remains committed to the sustainable production of soya through initiatives such as the Round Table on Responsible Soy (RTRS) and the US Soybean Sustainability Assurance Protocol.

Resilience of change

One of the key drivers for this change has been world commodity prices. Naturally, there is concern that should prices of key ingredients, most noticeably protein crops, fall, then the situation may reverse. World demand for human and animal feed is increasing on account of population growth and the impact of adverse weather events, so commodity prices are not expected to return back to traditional lower levels.

It is considered that the knowledge and experience gained has boosted confidence in the use of lower (protein) quality diets by the industry. Food and drink manufacturers have recognised that by-products and co-products can provide a revenue stream and help them control costs and be more competitive.

**Chart 12: UK imports of soybeans 2008-2012 (% of total UK soybean imports)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>76%</td>
<td>86%</td>
<td>73%</td>
<td>92%</td>
<td>90%</td>
<td>78%</td>
<td>91%</td>
</tr>
<tr>
<td>Canada</td>
<td>4%</td>
<td>6%</td>
<td>12%</td>
<td>6%</td>
<td>6%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>USA</td>
<td>18%</td>
<td>4%</td>
<td>8%</td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Argentina</td>
<td>1%</td>
<td>2%</td>
<td>6%</td>
<td>0%</td>
<td>1%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>China</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
<td>99%</td>
<td>100%</td>
<td>99%</td>
<td>98%</td>
<td>99%</td>
<td>99%</td>
</tr>
</tbody>
</table>

Source: HM Revenue & Customs - UK Trade Info (https://www.uktradeinfo.com/Pages/Home.aspx)
Farm productivity

Roadmap Objective: The aim of the Two Tonne Sow (2TS) project is to help English producers achieve an industry average of 2,000kg of pig meat per sow per year by 2014.

The success of the 2TS project is crucial in ensuring the long-term competitiveness of the English pig sector, by improving the financial performance and sustainability of every English herd. In doing so, it will further reduce the environmental impact of English pig production.

Data collected and analysed by the AHDB Market Intelligence unit, considered to be the most up to date and authoritative source of information tracking English pig production, shows improving performances of both the indoor and outdoor herds in England towards this target.

Tracking progress of the 2TS project to the final quarter of 2012 demonstrated a steady improvement in output, notably:

- The top third of indoor farms had achieved the target.
- The top 10% of outdoor herds are close to reaching the target and improving.
- The top 10% of indoor herds weaned an extra half a pig per sow per year.

Full details of the 2TS project are available at: http://www.bpex.org.uk/prices-facts-figures/costings/2tsprogressupdate.aspx

Finishing herd

Turning now to the physical performance of the finishing herd, the following points are evident from the performance efficiencies achieved between 2008 and 2012 (as illustrated in Chart 13).

- Average carcass weight remained relatively constant between 2008 and 2012, showing a slight increase of 1 per cent in 2012 compared with 2008.
- Feed conversion ratio remained relatively constant between 2008 and 2012 (though it did show a slight, if disappointing, decrease in 2012, which can be attributed to inferior feed quality due to the poor 2012 harvest and illustrating how outside factors, such as weather, can influence results).
- Daily weight gain showed a steady increase between 2008 and 2012, resulting in a 4 per cent increase in 2012 compared with 2008.
- Pig mortality decreased between 2008 and 2012, resulting in a 14 per cent decrease.

While there were signs of change, the improvement in farm physical performance in the finishing herd was not as great as initially hoped.

Chart 13: Year-on-year improvement for specific finishing herd parameters between 2008 and 2012 and forecast for 2020

Source: ERM LCA Update 2013
There are two possible reasons for this. Firstly, the improvement in quality of pigs leaving the breeding and rearing herds has not had sufficient time to make an impact on finishing. Secondly, performance in this area is already on a par with our leading European counterparts.

Absolute daily growth rates for GB finishing herds averaged 822g in 2012, relative to an EU average of 780g (Chart 14).

Improvements in GB finishing herd growth rates have also been strong over the past decade relative to other EU finishing herds, which have plateaued in the past two years.

This has resulted in GB finishing herds closing the gap in competitiveness in this area which may be as a consequence of great investment in finishing herd accommodation, switching to all in, all out (AIAO) systems and an overall improvements in herd health.

To stimulate focus on the Finishing stage of production, BPEX organised a Finisher Challenge in 2012 and made this the focus of its autumn conferences that year.

**PHWC Chairman, Prof Jim Scudamore, said:** “A great deal has already been achieved but there remain many challenges to be faced in the coming years. One of the most important issues is to establish the current performance baselines in a number of areas, especially in relation to health and welfare outcomes.

“Once the baselines are agreed and are scientifically sound, the next stage will be to agree practical, cost-effective, clear and achievable targets to improve health and welfare.

“It is important to develop clear targets and to describe how those targets will be measured. This will be an important activity for the PHWC.”
Pig health and welfare

Improving the health and welfare of pigs is of paramount importance to all involved in the industry in England and the 20:20 Pig Health and Welfare Strategy – a Vision for 2020, sets out a strategic approach for continuous improvement in pig health and welfare.

The Annual Report of the Pig Health and Welfare Council (PHWC) was launched by the Farming minister David Heath in September 2013. Among the key issues highlighted in the report and of relevance to Roadmap activity were:

- The Pig Health Improvement Project, a core driver for improvement.
- The focus on the responsible use of antimicrobials, which is becoming ever more important.
- Knowledge transfer, which is key to improve training and stockman skills.
- Horizon scanning to identify threats from new and emerging diseases.

The Pig Health Improvement Programme (PHIP) continues to develop a partnership approach to better pig health, working as a facilitator between local groups of farmers, vets and abattoirs. This includes:

- BPEX Pig Health Scheme (BPHS) abattoir reports.
- Local pig herd health status mapping.
- Biosecurity Action Plan.
- Disease testing.
- BPEX Regional Health Improvement Managers.

Pig veterinary surgeons are becoming more involved in the management of their clients’ herds and providing added value services such as training events and regional Pig Fairs where a range of compatible service suppliers are brought together to meet producers.

Farm buildings

The age and condition of farm buildings is often quoted as a barrier to production improvement. A survey conducted last year by BPEX, which showed that the typical pig farm building was more than 20 years old, also revealed the following key findings:

- 90 per cent of farms sampled stated that their current facilities were not ideal and they wished to invest in new buildings.
- There is a wide range in time since investment was last made in new facilities but many producers have made no substantive replacement or extension to their housing in the past ten years.
- Buildings were generally felt to be fit for purpose, on account of monies spent on refurbishment, but could not match newer equivalents.
- Many pig producers still see improvement in physical performance in order to achieve reductions in the cost of production as the main reason for contemplating investment in both facilities and new technology. But better use of labour and the desire to improve animal welfare also featured strongly.
- Planning permission and legislation, such as Environmental Permitting, are barriers even greater than that of obtaining finance.
With these findings in mind, the following actions can be reported:

- Over 200 copies of a BPEX manual for the design, build and operation of finisher housing have been distributed to BPEX levy payers and their advisors.

- A Buildings Forum of leading building and equipment suppliers and the NPA was facilitated by BPEX to discuss pre-competitive issues including new technologies, latest research and legislative matters.

- The NPA has been active with Government on issues surrounding difficulty in obtaining planning permission for new buildings, largely on the ground of public opposition.

There was positive feedback from participants, who reported that many of the recommendations made had been implemented on farm. The subject continues to generate interest and a BPEX Ventilation Manual is currently in development and BPEX staff have been trained to deliver Thermal Management workshops.

### Communications

**Roadmap objective:** The Pig industry’s governing bodies remain committed to investing in and evaluating the benefits of new ways of communication and of disseminating information that will enable all sectors of the industry to improve their capabilities and efficiencies.

**Webinars**

Throughout the pig industry in England there is growing use of telecommunications and the Internet, including the use of teleconferencing and webinars. BPEX first successfully trialled webinars in November 2011 and, to date, has run 16 with a capacity of 100 registered participant destinations with multiple participants at each destination.

Online workshops, via BPEX’s webinar programme, are proving popular and for those unable to join the live webinar, the presentations remain available from the BPEX website. The example below can be viewed at: http://www.bpex.org.uk/events/webinars/default.aspx
Study tours
Study tours continue to be a source of learning and inspiration for pig producers. Under the auspices of BPEX, the European Pig Producers Association, NPA and commercial companies, these have included well-attended visits to overseas farms, supply businesses and exhibitions such as SPACE, Eurotier and AgriTechnica.

Electronic animal movement
The industry has moved to an electronic system of reporting pig movements – known as eAML2 – replacing the former paper based system. Movements are registered online and, once set up, the producer receives confirmation either online or by text message. Details are available at: http://www.bpex.org.uk/Article.aspx?ID=302733

Pig Clubs
The number of Pig Clubs and discussion groups around the country where producers and those associated with the industry can exchange ideas and gather information remains a vibrant resource and provides a valuable service. The larger, integrated businesses recognise the value of skills and knowledge and are increasingly organising their own internal training for staff and contracted production businesses. These cover a whole range of subjects and examples range from practical skills to understanding legislation.

Skills and development
Roadmap objective: The continued development and encouragement of young people in the industry and giving them responsibility is a foundation stone of the roadmap. Recognising the importance of the pig industry’s need to attract and retain highly skilled and motivated staff, BPEX, in association with Defra and with participation from Lantra, NPA and others, launched its Skills Strategy in 2013.[12]

The objective of the strategy is to attract and retain highly motivated and enthusiastic people into the industry and provide training in a format that is practical, relevant and easy to access. The aims are to:

- Promote skills development as being central to business improvement.
- Develop a skills and qualifications structure that is relevant to industry needs and accessible at all levels and flexible in structure.
- Provide and promote an attractive environment for a progressive career in the pig industry.

Roadmap objective: The Pig Industry Professional Register (PIPR) will continue to measure and stimulate Continuous Professional Development (CPD) within the industry. From April 2013, the Red Tractor Assurance scheme has included the recommendation that staff and workers in the pig sector demonstrate their competence by being a member of a recognised scheme that records skills, development and training activity[13], such as PIPR (the Pig Industry Professional Register).

Water
Roadmap objective: Training and discussion group activity will promote local benchmarking and knowledge exchange to facilitate improvement. BPEX has initiated Innovation Fund studies on improving water quality supplied to pigs. This project resulted in the feed intake per sow increasing by 30kg per lactation, following treatment with a product to remove biofilm from supply systems[14]. Discussion group and PHIP activity throughout the industry continues to include water quality as a topic.

Biodiversity and habitats

BPEX and the NPA will continue to develop an understanding of the issues through dialogue with statutory bodies, communicate with the industry and seek solutions balancing the needs of all parties.

During the period 2011 to 2013, the NPA and BPEX have continued actively to engage with regulators and statutory bodies on matters concerning habitats and the environment.

Examples at a national level include Defra’s nitrates team on Nitrate Vulnerable Zone Regulation and the water quality team on Water Framework Directive implementation.

At a regional level, activity includes working with the Environment Agencies project on the impacts of outdoor pigs on surface water quality in East Anglia.

Both BPEX and NPA continue to disseminate information at regional events and via publications including Pig World.

Processing, retail and exports

Roadmap Objective: Further projects and opportunities for working together will make this part of the pigmeat supply chain more sustainable, including developing home and export markets so that value from the whole carcase can be maximised.

The promotion of exports and market development will continue.

Industry organisations, BMPA, BPA, BPEX and NPA, have been working to develop markets both at home and overseas to ensure best returns for the industry and to maximise carcase yield. Exports of fifth quarter carcase products to the Far East is a significant success story[^1]. Shipments to China continued to grow with 15 per cent more pig offal traded.

The total value of UK pig meat exports stood at just over £275 million in 2012 (Chart 15).


### Chart 15: Value of total UK pig meat exports

<table>
<thead>
<tr>
<th>(£’000)</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh/frozen meat</td>
<td>132,210</td>
<td>115,685</td>
<td>148,938</td>
<td>171,274</td>
<td>189,285</td>
</tr>
<tr>
<td>Bacon</td>
<td>71,769</td>
<td>51,355</td>
<td>44,499</td>
<td>59,440</td>
<td>36,987</td>
</tr>
<tr>
<td>Sausages</td>
<td>13,977</td>
<td>14,699</td>
<td>14,910</td>
<td>13,951</td>
<td>16,851</td>
</tr>
<tr>
<td>Processed hams, shoulders and pieces*</td>
<td>43,484</td>
<td>43,562</td>
<td>35,564</td>
<td>27,267</td>
<td>32,502</td>
</tr>
<tr>
<td>Total</td>
<td>261,440</td>
<td>225,301</td>
<td>243,911</td>
<td>271,932</td>
<td>275,605</td>
</tr>
<tr>
<td>Live pigs</td>
<td>3,044</td>
<td>2,953</td>
<td>2,504</td>
<td>5,950</td>
<td>1,863</td>
</tr>
</tbody>
</table>

* including canned. Source: GTIS, HM Revenue and Customs
Future Projections

In almost every regard, the Roadmap for the English Pig Industry can be regarded as outstandingly successful to date.

The industry has made considerable progress towards improving its sustainability objectives while delivering safe and affordable products. Much of this progress was delivered by the Feed Industry through high inclusion rates of co-products and by-products and the reductions in overall protein levels.

Performance gains in farm productivity have also contributed, albeit to a lesser extent.

Moreover, the trends point towards continued improvement with engagement by producers in initiatives such as the Pig Health Improvement Programme, skills and training. Their desire for new ideas, willingness to learn from high-performing overseas competitors and other industries, coupled with desire to invest in new facilities, provides confidence that the course is set for better progress, provided positive returns on investment can be sustained.

Key performance targets for English pig producers remain unchanged (Chart 16).

The impact this improvement is predicted to contribute to the targets for reduction of the pig industry’s environmental impact has been recalculated using the more accurate data now available (Chart 17). It is assumed changes in nutrition and diets that have already been implemented will continue.

Chart 16: Key performance targets for English pig producers

<table>
<thead>
<tr>
<th>Pig performance</th>
<th>2008</th>
<th>2014</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of pigs at weaning (kg)</td>
<td>7.70</td>
<td>7.90</td>
<td>8.00</td>
</tr>
<tr>
<td>Pigs weaned per sow per year</td>
<td>22.1</td>
<td>25.6</td>
<td>28.0</td>
</tr>
<tr>
<td>Finishing mortality (%)</td>
<td>3.3</td>
<td>2.0</td>
<td>1.8</td>
</tr>
<tr>
<td>Rearing feed conversion ratio</td>
<td>1.7</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Finishing feed conversion ratio</td>
<td>2.87</td>
<td>2.40</td>
<td>2.30</td>
</tr>
<tr>
<td>Finishing daily live weight gain (g)</td>
<td>766</td>
<td>835</td>
<td>875</td>
</tr>
<tr>
<td>Ave. live weight at slaughter (kg)</td>
<td>103.05</td>
<td>110.0</td>
<td>110.0</td>
</tr>
<tr>
<td>Ave. dead weight (kg)</td>
<td>79.77</td>
<td>81.30</td>
<td>86.00</td>
</tr>
<tr>
<td>Killing out percentage (cold)</td>
<td>77.0</td>
<td>75.5</td>
<td>76.0</td>
</tr>
<tr>
<td>Sow feed per sow per year (kg)</td>
<td>1,456</td>
<td>1,560</td>
<td>1,360</td>
</tr>
<tr>
<td>Pigmeat per sow per year (kg)</td>
<td>1,608</td>
<td>2,000</td>
<td>2,200</td>
</tr>
</tbody>
</table>

Chart 17: Comparison of 2012 results and 2020 forecast – per kg of pork

<table>
<thead>
<tr>
<th>Impact category</th>
<th>Unit</th>
<th>2012</th>
<th>2020 forecast</th>
<th>% improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>kg CO₂-eq</td>
<td>4.551</td>
<td>4.116</td>
<td>10%</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>kg PO₄-eq</td>
<td>0.062</td>
<td>0.059</td>
<td>6%</td>
</tr>
<tr>
<td>Acidification</td>
<td>kg SO₂-eq</td>
<td>0.187</td>
<td>0.180</td>
<td>4%</td>
</tr>
<tr>
<td>Resource depletion</td>
<td>kg Sb-eq</td>
<td>0.008</td>
<td>0.007</td>
<td>11%</td>
</tr>
</tbody>
</table>

Source: ERM LCA
Pig feed is still expected to make up over 60% of the environmental burdens to the farm gate.

As shown in Chart 18, the rearing herd is forecast to deliver the largest improvements across the production stages. The contribution of the finishing herd is projected to actually increase on account of poorer feed quality, greater feed inputs and higher slaughter weights.

It is with some confidence, therefore, that the industry is predicted to exceed the targets for reduction of environmental impacts contained in the Roadmap of 2011. These revised predicted targets are set out below (Chart 19).

This gives great encouragement to a sector whose tough recent history will be sufficient guard against complacency. Competitive pressures will remain. But, by using resources more intelligently and efficiently, the industry will not only be better placed to exceed the targets of reducing its environmental impacts, it will also be better able to withstand future regulatory pressures and be more resilient to global economic crises and the effects of weather and climate changes.

The industry’s representative bodies and producers will continue to work together on the many issues in partnership.

Chart 18: Forecast environmental improvements per life cycle stage - 2012 to 2020

<table>
<thead>
<tr>
<th>Impact category</th>
<th>Breeding herd</th>
<th>Rearing herd</th>
<th>Finishing herd</th>
<th>Sow replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>12%</td>
<td>38%</td>
<td>(2%)</td>
<td>31%</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>14%</td>
<td>37%</td>
<td>(4%)</td>
<td>28%</td>
</tr>
<tr>
<td>Acidification</td>
<td>17%</td>
<td>36%</td>
<td>(8%)</td>
<td>27%</td>
</tr>
<tr>
<td>Resource depletion</td>
<td>13%</td>
<td>37%</td>
<td>(1%)</td>
<td>31%</td>
</tr>
</tbody>
</table>

Source: ERM LCA

Chart 19: Comparison of 2008, 2012 and 2020 results – per kg of pork

<table>
<thead>
<tr>
<th>Impact category</th>
<th>Unit</th>
<th>2008</th>
<th>2012</th>
<th>2020</th>
<th>% improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>kg CO2 eq</td>
<td>6.18</td>
<td>4.55</td>
<td>4.12</td>
<td>33%</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>kg PO43- eq</td>
<td>0.072</td>
<td>0.062</td>
<td>0.059</td>
<td>18%</td>
</tr>
<tr>
<td>Acidification</td>
<td>kg SO2 eq</td>
<td>0.207</td>
<td>0.187</td>
<td>0.180</td>
<td>13%</td>
</tr>
<tr>
<td>Resource depletion</td>
<td>kg Sb eq</td>
<td>0.0090</td>
<td>0.0083</td>
<td>0.0074</td>
<td>19%</td>
</tr>
</tbody>
</table>

Source: ERM LCA