# Dairy
# Towards net zero

**The highest contributor of greenhouse gas emissions from dairy farms is methane (40%) from rumination of livestock. 24% of emissions are nitrous oxide emitted from fertiliser, manure storage and soil management. Feed accounts for 26% of emissions and the remaining 10% arises mainly from energy use (Figure 1)[1].**

## Emission challenges

### Methane from livestock digestion

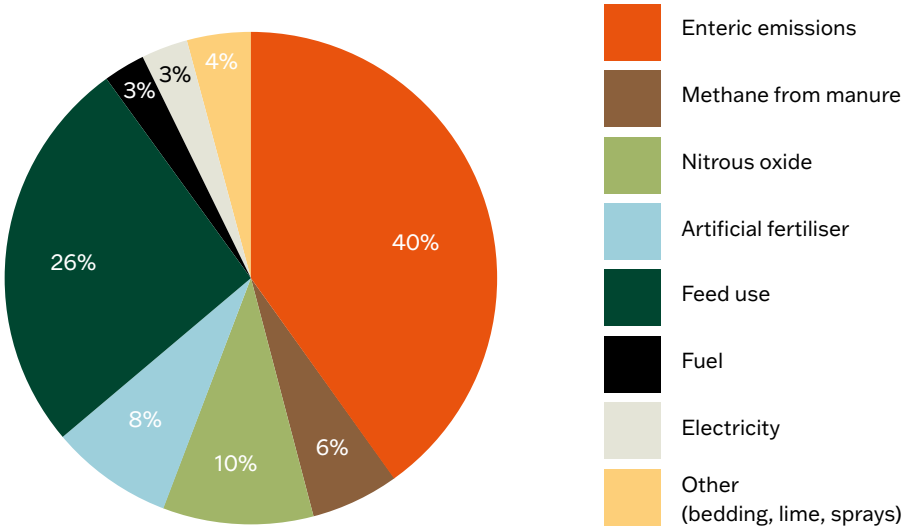
When the bacteria in the rumen break down fibre, cows emit methane into the atmosphere. Ruminant diets need high amounts of digestible forage to support good production so methane mitigation will be key for the dairy industry to reach net zero.

The total dairy breeding herd is approximately 1.87 million down from over 2 million during the early 1990s[2].

### Feed imports

Feed production and imports account for approximately 26% of the emissions from milk production[1]. Embedded in the concentrates and straights fed to cows are emissions associated with growing, storing, transporting and processing the feed. Feeds associated with land use change (e.g. soya), brought onto a dairy farm, will tend to have higher emission factors.

**Figure 1** Sources of greenhouse gas emissions from UK dairy farms[1]




### Product losses

Losses due to unproductive animals, including waste milk and culling, contribute to higher emissions per unit of milk sold. Anything which increases the herd replacement rate or milk wastage such as lameness, infertility, infectious disease, deaths from injury will indirectly increase a herd's carbon footprint.

### Nutrient and soil management

Nitrous oxide emissions contribute between 24-40% of total emissions. These emissions result from nitrogen turnover in soil from the use of synthetic fertilisers and manure and excreta deposited during grazing. Soil type, drainage, degree of soil compaction and climate all influence the emissions of nitrous oxide.

## Short term solutions to reduce emissions

Improvements that individually seem small can add up and result in significant reductions.

### Animal health & welfare

Emissions can be reduced by: maintaining good bio-security; improving cow comfort and cleanliness; investing in an efficient milking system (including robotics) and; ensuring calf and heifer rearing will achieve a 24 month age at first calving. Investment in systems that track cow behaviour like locomotion, lying and eating time and fertility events facilitate even more precise assessment and better decision making. Such information systems can be embedded in the housing and milking parlour facility.

### Feed efficiency

Methane emissions represent a loss of ingested gross energy of between 2% and 12% of the energy ingested. Dietary manipulation and the use of feed additives have been shown to alter the rumen microbiome to reduce emissions. Higher quality feeds and supplements (e.g. seaweed) can reduce emissions per head per day quite significantly. Increasing the fat content (from 3.5% to over 5.5%) has shown an average reduction in methane emissions of 11%. Build diets from ingredients with low embedded carbon levels. In particular, avoid using feeds that involve land-use change (e.g. soya).

## Long term investments

### Breeding the next generation of cows

Improving the management of replacements and maximising value from calf sales will help reduce emissions from the farm.

- **Increase genetic merit by using indices to identify potential performance improvements related to increased solids, better health traits and increased longevity.**
- **Reduce disease and tackle issues like mastitis to reduce infections.**
- **Improve management of fertility, pregnancy rates, calving and replacements through use of sexed semen and management of AI. Lowering replacement rates from 30% to 25% will mean that there are 17% fewer heifer replacements on farm, greatly reducing emissions.**
- **Ensure first calving age is 24 months. This is achievable for all breeds and significantly improves lifetime yield and reduces greenhouse gas emission by 6%.**

### Nutrient management

In order to reduce nitrous oxide emissions on dairy farms consider:

- **Using biological fixation to provide nitrogen inputs (clover) to pasture.**
- **Reducing mineral fertiliser usage.**
- **Improving land drainage.**
- **Fully accounting for nutrients in manure/slurry.**
- **Improved timing and accuracy of mineral fertiliser application, slurry and manure.**
- **Using nitrification inhibitors.**

Covering slurry stores reduces emissions by 60-80% and will increase the amount of nitrogen in the slurry[3]. Switching to low emission spreading equipment, such as trailing shoe or shallow injector, can reduce emissions by 60 – 70%[3]. In the field, actively focus on increasing the efficiency of mineral nitrogen fertiliser use and improving soil health to help reduce nitrous oxide emissions.

### Energy efficiency

Energy use on dairy farms is associated with heating water, cooling milk and lighting. Installing variable speed milk and vacuum pumps, and heat recovery systems offer good potential for energy savings and emission reductions. Heat exchanges can save up to 60% of energy costs. A variable speed milk pump will cool the liquid by an extra 15 to 20 degrees. LED energy saving lighting, installed with timers to give cows the right amount of daylight hours has been proven to reduce energy use and increase milk production by up to 5%.

### Agri-tech

Robotic milking systems are gaining popularity with a 6 – 15 year payback period for return on investment[4]. Livestock sensors have also been shown to increase milk yield by up to 10% helping raise productivity and lower emissions per litre of milk[5].



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