3. Introduction

In this guide

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Globally, the food system (including agriculture, food manufacturing and processing, distribution and retail) produces greenhouse gas (GHG) emissions of about 18 Gigatonnes CO2 equivalents (GtCO2e) per year – about one-third of total emissions and second only to the energy sector (Ward, 2023). In 2015, 71% of these emissions came from the land-based sector, defined as agriculture and associated land use and land use change (LULUC; sometimes combined with forestry as LULUCF). Primary production of food and animal feed is, therefore, a significant contributor to GHG emissions.

In the UK, the food system accounts for 23% of GHG emissions, a percentage that has remained almost constant since 1990. Although emissions from primary production of food and feed decreased from 66.9 Megatonnes CO2 equivalents

(MtCO2e) per year in 1990 – 1999 to 54.9 MtCO2e per year in 2010 - 2018, their overall contribution to food system emissions increased from 42.6% to 48.3% in the same period (Ward, 2023). It is generally recognised that reducing GHG emissions from the food system has lagged behind that of sectors such as electricity generation and road transport (OECD, 2019). As decarbonisation proceeds there is likely to be a greater focus on both the absolute and relative contributions of GHG emissions from the food system to total GHG emissions.

The UK's Net Zero Strategy (BEIS, 2021) sets out the UK government's ambitions to decarbonise the economy, reduce the extent of climate change and associated extremes of weather and build a greener, climate-resilient economy. Emissions from agriculture and LULUCF are expected to contribute reductions over the next decade (Figure 1). The strategy acknowledges that primary production (agriculture) 'will be difficult to decarbonise completely by 2050', but that the processes of carbon fixation embedded in agriculture can make a significant contribution to mitigating total GHG emissions.

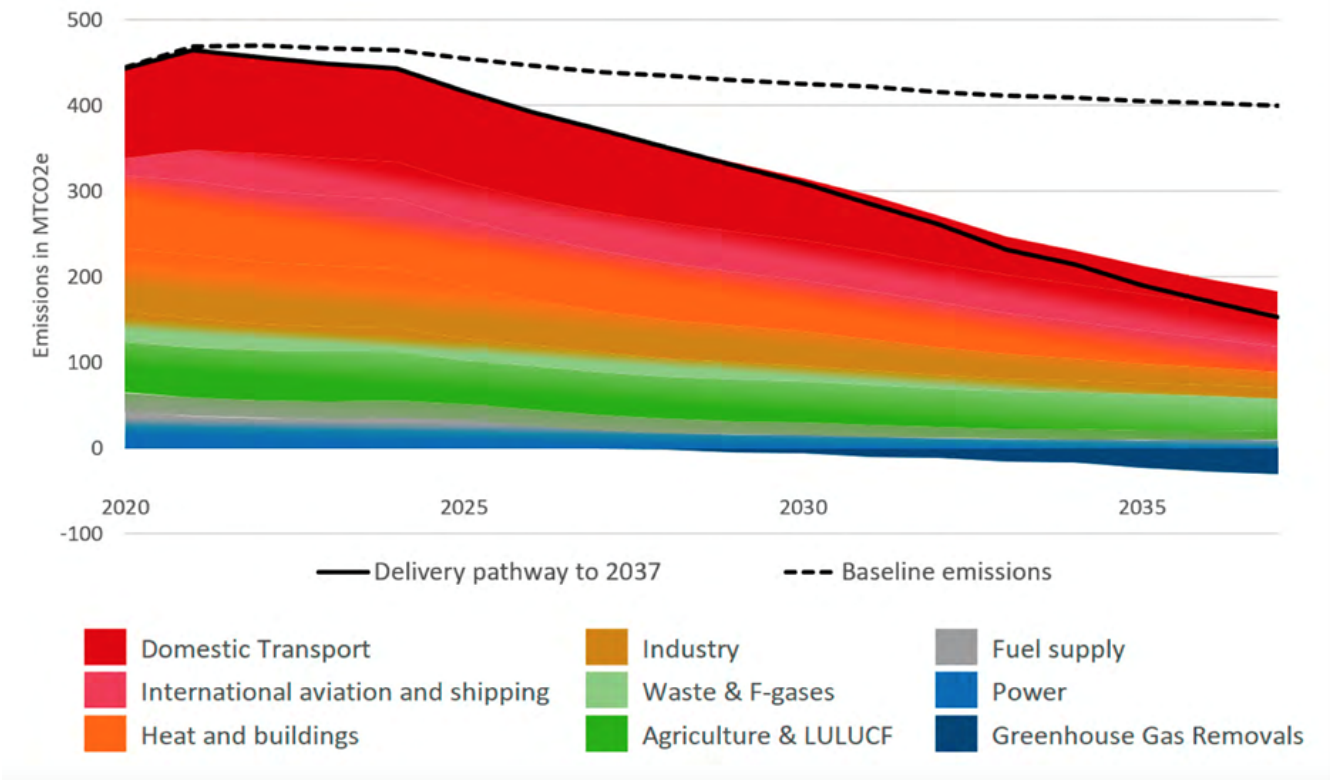

Figure 1. The anticipated contributions of different sectors to reducing UK GHG emissions (BEIS, 2021). Note that the years on the x-axis should be placed below the -100 line.

In early discussions to scope the work detailed in this report, the FSA Science Council Secretariat agreed with Defra that there are many new developments occurring in primary food production aimed at achieving net zero carbon that may have implications for food safety. The Science Council decided, therefore, to focus on changes expected in the primary production of food in the next decade concentrating on, but not limited to, production in the UK. Similar production systems elsewhere are likely to produce similar potential food safety risks for imported food. For the purposes of this review, primary food production includes the growing and harvesting of plants as food for humans or feed for animals, and the rearing and slaughter of animals (livestock, fish and a wide variety of aquatic and marine organisms). It also encompasses simple processing of agricultural products ‘on farm’ such as grinding grain for flour, pasteurising milk and packaging of fresh fruit and vegetables for sale, as well as the development of new production systems including insects and cell culture for growing meat, fish and milks. Whenever production systems change, potential food safety risks change too, either because new risks are introduced and/or the balance of already known risks is altered. This study aimed to determine the potential risks to food safety contingent on changed food production practices aimed at achieving net zero carbon and highlight areas where vigilance is needed.

A Science Council Working Group 6 (WG6) began work in summer 2021, led by Science Council members Mrs Claire Nicholson (WG6 Chair) and Prof Jonathan Wastling (WG6 Deputy Chair) with advice and support from Profs Peter Gregory, Simon Pearson and John O’Brien; Secretariat support was from Mr P Nunn. Its aim was:

‘to investigate the potential food safety implications arising from changes in primary food production practices and technologies introduced in the UK aimed at reducing carbon emissions in the next decade.’

The work programme comprised four phases with an interim report published in July 2022 (FSA, 2022c). The interim report summarised the first two phases and provided a preliminary indication to the FSA of changes to practice already underway and an early view of possible food safety issues. Interviews with scientists and leading industry stakeholders were conducted in three tranches interspersed with two workshops with academic, industry and government department representatives, together with a review of academic, industry and government publications. A full description of the methodology employed is given in Annex 1.

In undertaking this work, the WG6 employed the FSA's standard approach to risk assessment. Risk assessment involves using a scientific approach to identify and define hazards, and to estimate potential risk to human and/or animal health. This includes evaluating the likely exposure to risks from food and other sources. New technologies may give rise to emerging risks defined as 'a risk resulting from a newly identified hazard to which a significant exposure may occur or from which an unexpected new or increased significant exposure and/or susceptibility to a known hazard' (EFSA, 2011). Innovations to support carbon reduction may have both positive and negative consequences for food safety and there is a dynamic, two-way relationship between environmental impacts and food safety. Potential health risks and routes to exposure to known hazards may change in response to net zero carbon measures necessitating changes in control practices or product and process standards.

This final report covers all four phases of the WG6's activities. It identifies many rapid changes occurring in primary food production practices that will contribute to the realisation of net zero carbon, and the potential food and animal feed safety issues arising from them. It highlights the significant areas of uncertainty that will require ongoing monitoring, and which may necessitate a rapid response. Finally, it makes recommendations to the FSA of areas for further action or investigation and highlights the need for work in partnership with other government departments to manage potential food safety risks.