An assessment of greenhouse gas emissions from the UK food system and the scope for reduction by 2050.

How low can we go?

When it comes to environmental impacts, the usual suspects have been mobility (the way we get around) and energy (the way we heat and light our buildings). However, there's an equally significant actor in the creation of greenhouse gases: food. Some 20% of the UK's greenhouse gas emissions can be attributed to what we put on our plates.

The UK has its own legally-binding targets to reduce production emissions by 80% by 2050 under the Climate Change Act. In order to make a proportional contribution to these reductions, and taking into account the fact that we need to continue to eat, WWF-UK and the Food Climate Research Network (FCRN) suggest food-related emissions need to be cut by 70% by 2050. Achieving this is highly likely to require significant changes throughout the UK food system – from production and processing to cooking, the kinds of food we eat and what and how much we throw away.

The aim of this study was thus to determine the feasibility of a 70% cut, where in the food chain cuts could be made, and by how much. In addition, the work estimated the emissions arising from direct and indirect land use change attributable to UK food consumption. This was done by calculating how much land, including forest, is converted annually to agriculture and the CO_2 emissions that arise from this process, and attributing an appropriate amount of these emissions to UK food consumption.

As such, this study provides the most accurate inventory of greenhouse gases attributable to UK food consumption to date: the results were striking – and disturbing. As stated above, direct emissions from the UK food chain are estimated to be about 20% of the UK's total consumption emissions. However, according the method and assumptions used in the study, including the emissions attributable to direct and indirect land use change lifts the proportion of UK consumption emissions attributable to food from 20% to 30% of all UK emissions – or from 152MtCO_2 to 253MtCO_2. Reducing emissions from food will thus be key to tackling climate change.

This study investigated a range of approaches to making the cuts, constructing three broad thematic scenarios (eee figure 1).

The first was an energy-based scenario in which the focus was on (a) the decarbonisation of non-mobile processes, such as food processing, cooking and refrigeration and (b) the decarbonisation of energy used in transport. The result? Cuts of some 57% by 2050. Not enough.

The second was an emissions-led scenario which centred on (a) reductions in direct GHG emissions, such as methane from cows and sheep and nitrous oxide from fertilisers and (b) improved production efficiency, including increased crop yields and improved livestock genetics. The result? Cuts of some 55% by 2050. Again: not enough.

The final scenario considered (a) conservation, through waste avoidance and using wasted food to generate energy and (b) changes to consumption patterns in the UK. The result? Cuts of some 60%. Getting there, but still not enough.

Figure 1: The three potential reduction scenarios

Scenario 1: decarbonisation

- "**Non-mobile energy**" – reducing GWP (global warming potential) from the fuel input to non-mobile equipment that typically use electricity or gas, such as ventilation and cooking. Typically this would comprise use of renewable energy for electricity or nuclear power, with a shift from gas to electricity in food preparation.
- "**Mobile energy**" – reducing GWP from the fuel input to mobile equipment that typically use diesel and also GWP from fertiliser production from gas. Typically this would involve replacing diesel with hydrogen or electric engines in vehicles and a new method of fertiliser production using electricity not gas.

Scenario 2: emissions-led

- "**Direct GHG emissions**" – directly reducing direct emissions of GHGs to the atmosphere: refrigerants, methane, nitrous oxide. Typically this would be non GHG refrigerant gas and techniques for reducing methane emitted by ruminants.
- "**Production efficiency**" – reducing GWP by reducing waste, increasing food conversion efficiency and crop yields, and reducing the energy required in the production processes of food.

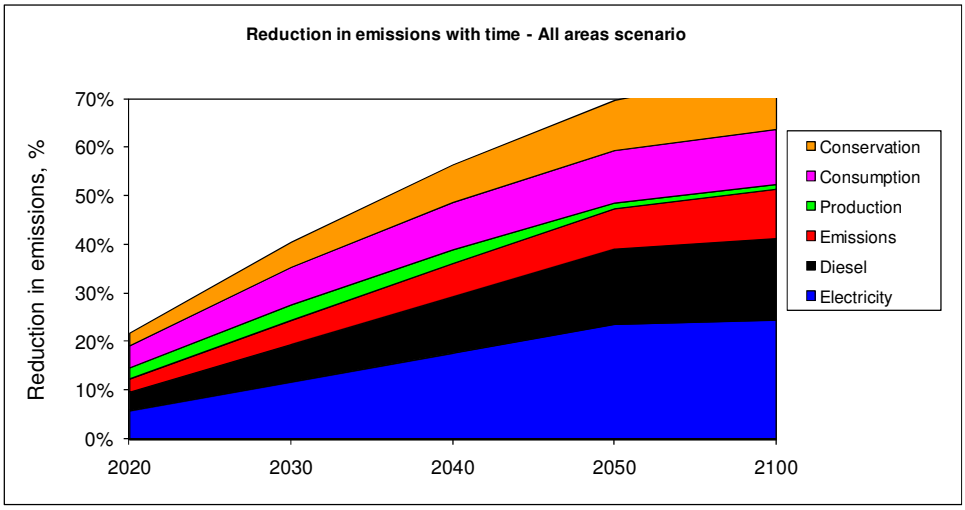
Scenario 3: consumption-led

- "**Consumption**" – changing consumption patterns.
- "**Conservation**" – recycling and avoiding wasteful use.

Some might argue that sufficient progress in the first two scenarios – decarbonisation and emissions reductions – will provide the cuts required. We infer from this study that they won't be enough. De-carbonising the nation's energy supply to the extent modelled in the decarbonisation scenario will be very difficult and expensive. Equally, as the report notes, 'reducing field nitrous oxide emissions and enteric methane emissions are particularly speculative and their full elimination may not be technically possible.'

So reaching a 70% reduction in GHG emissions by 2050 is highly likely to require a combination of approaches. These include not only decarbonisaton of the general economy, production efficiencies, reductions in waste and nitrous oxide and methane emissions abatement, but also changes in the type of foods we consume. Figure 2 (below) shows the make-up of the 'all themes scenario' and how, under this scenario, the 70% target can be reached.

Figure 2: Emission reductions over time as affected by the rate of implementation of all categories of measures



Hence, one of the conclusions of this study's modelling is that a reduction in consumption of livestock products could play a significant role in any deep and long-term abatement strategy to cut emissions from the UK's food chain.

The extent to which consumption needs to be cut will depend on the extent of progress in decarbonisation of the UK energy supply, technology and efficiency. This is just one scenario mix: the important point is that we are highly likely to need both technological and behavioural change to achieve reductions of this magnitude – and help avoid dangerous climate change.

WWF-UK and FCRN's views of the implications of the report

Perhaps the most controversial proposal to reduce GHG emissions from the food chain is to attempt to change patterns of consumption – what it is we eat.

Globally, most people do not consume nearly as much meat and dairy products as we do here in the UK. If UK dietary habits were to become prevalent across the developing world, a huge expansion in global land area devoted to livestock production would be required. The expansion in livestock production would not only lead to increases in direct emissions but would also further increase emissions arising from land use change. So, it seems fair that we in the UK should consume fewer livestock products in order that those in the developing world, many of whom are undernourished, can consume a little more.

There is a growing body of scientific research that highlights the importance of cutting meat and dairy consumption both for environmental reasons, but also because of the potential health benefits to be gained. The recent report in The Lancet (source 1) – which attracted some limited support from Government – and the Sustainable Development Commission's *'Setting the Table'* report (source 2) are cases in point.

This WWF-UK and FCRN study did not consider the impact of diet on land use change in detail, nor deal with the issue of land quality, and its potential to produce different types of food. These ideas will be dealt with in a follow-up study tackling the question of how changing consumption will affect land use.

Unfortunately, the Government's new food strategy, Food 2030, published earlier this month, seemed to side-step the issue of livestock consumption stating "the evidence to inform appropriate consumer choices and policy responses is currently unclear". We find it disappointing that the Government has given the evidence on livestock product consumption so little credence and that it has parked the debate as an issue concerning "some groups". We hope that publication of the findings of this report will cause Government to take this issue more seriously.

There are many questions that still require answers. The onus is on the UK Government, therefore, to engage in an open and honest debate about the connection between diet, sustainability, health and global food security.

The wider aim of the document is to stimulate debate about the full GHG impact of the UK food chain and the scope and options for achieving reductions, as part of a wider UK climate change policy. Such a debate should involve engagement and collaboration of a wide range of stakeholders across the food chain including Governments, the food industry and civil society.

We know enough now to conclude that the UK food system contributes very substantially to the problem of climate change – in fact, more substantially than we previously thought given the emissions from land use change. We also know enough about how the impacts arise to do something about them. The question is: will we?

The full report is available at: `http://assets.wwf.org.uk/downloads/how_low_report_1.pdf`

Source 1: http://www.thelancet.com/series/health-and-climate-change

Source 2: http://www.sd-commission.org.uk/news.php/313/ireland/setting-the-table-sdc-advice-to-government-on-sustainable-diets