

Evidence for the Pig Sector Farmer-Led Climate Change Group

Briefing

The report highlights evidence on Scotland's pig sector for the Pig Sector farmer-led group, focussing on greenhouse gas emissions.

Sector Emissions

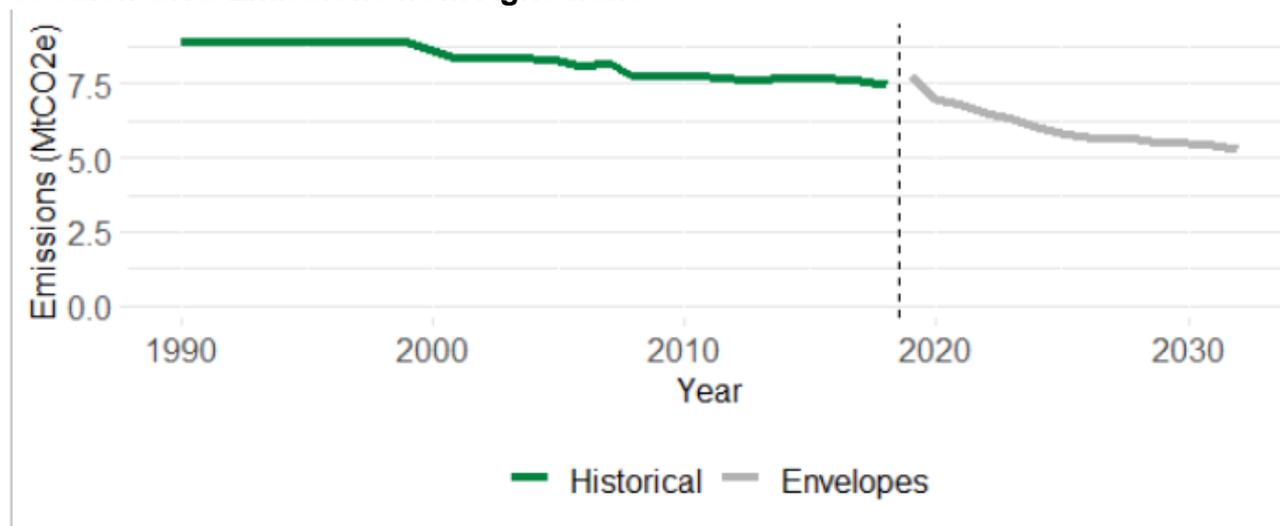
The Scottish Government has committed to reaching net zero emissions by 2045, including a reduction of 75% by 2030. Whilst a number of countries have adopted net zero targets by on or around 2045, Scotland's 2030 target is particularly ambitious and requires quick action.

Scotland has a legal requirement to meet these goals, and every industry must adjust to contribute to reducing emissions. The Greenhouse Gas inventory measures the domestic emissions, i.e. those produced in Scotland. It is the key data source against which Scottish Government measures its progress against its net zero targets. Emissions arising from goods produced in Scotland and exported overseas for consumption are counted in the Scottish GHG inventory. Emissions arising from goods produced overseas and imported into Scotland for consumption are not counted in the Scottish GHG inventory.

In 2018 total Scottish emissions were 41.6 million tonnes of carbon dioxide equivalent (MtCO₂e). The 2019 figures are scheduled to be published in summer 2021.

In 2018 emissions from agriculture were 7.5 MtCO₂e, or 18% of Scottish emissions. The sectoral envelope as set out in the Climate Change Plan update requires reductions of agricultural emissions of 2.4 MtCO₂e to 5.3 MtCO₂e¹ by 2032, a 31% reduction from 2018 levels. As shown below this requires agriculture to reduce emissions at a pace nearly four times faster than historic reductions. Progress towards delivering the plan will be part of statutory annual reporting at a sector-by-sector level, to the Scottish Parliament from May 2021 onwards.

Scottish GHG Emissions from Agriculture



Source: [Scottish Greenhouse Gas Emissions 2018 - gov.scot \(www.gov.scot\)](https://www.gov.scot/publications/scottish-greenhouse-gas-emissions-2018/pages/introduction.aspx), [Securing a green recovery on a path to net zero: climate change plan 2018–2032 - update - gov.scot \(www.gov.scot\)](https://www.gov.scot/publications/securing-a-green-recovery-on-a-path-to-net-zero-climate-change-plan-2018-2032-update/pages/introduction.aspx)

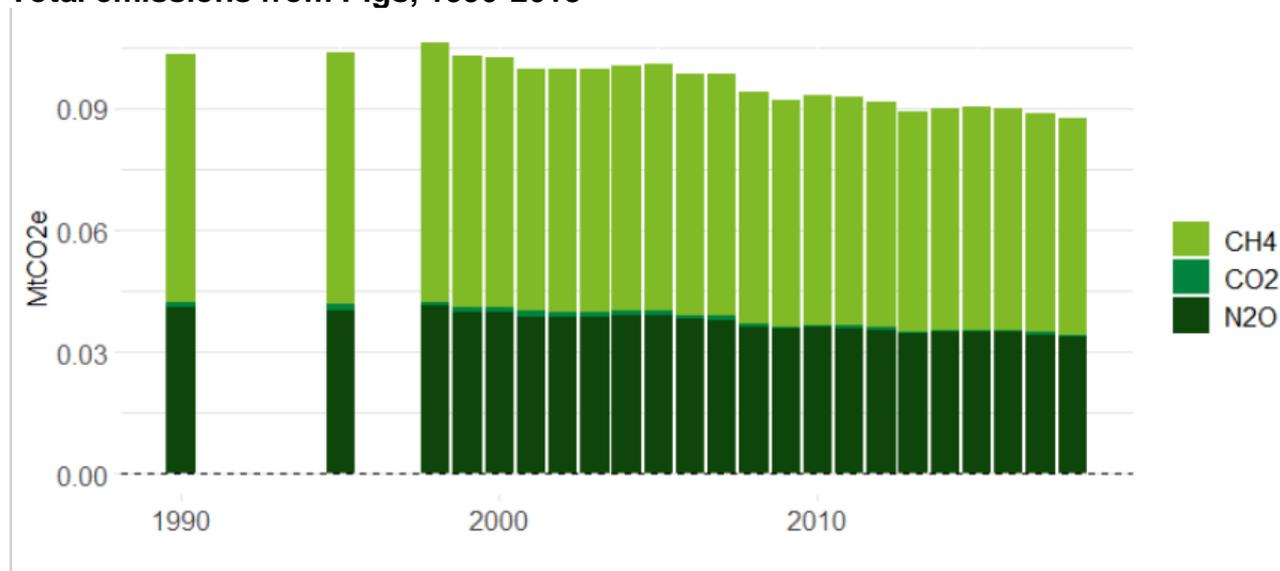
Note: there is a small break in the series due to a slight mismatch in the historic data and the forecast envelopes

¹ The Climate Change Plan update incorporates some likely methodological changes not yet included in GHG inventory figures resulting in 7.7 MtCO₂e in 2018 rather than 7.5.

GHG emissions from pigs

As shown in the chart below pigs contributed 0.09 MtCO₂e in 2018, or 1% of agricultural emissions. This is a 0.05 MtCO₂e fall since 1990, or 36%, driven by a reduction in emissions from manure management. The number of pigs in Scotland has reduced by nearly 30% over the same period, to around 319,000 in 2019. However, the amount of pig meat produced has increased by around 27% between 2003 and 2019².

Total emissions from Pigs, 1990-2018



Source: [Scottish Greenhouse Gas Emissions 2018 - gov.scot \(www.gov.scot\)](https://www.gov.scot/publications/scottish-greenhouse-gas-emissions-2018/pages/10.aspx)

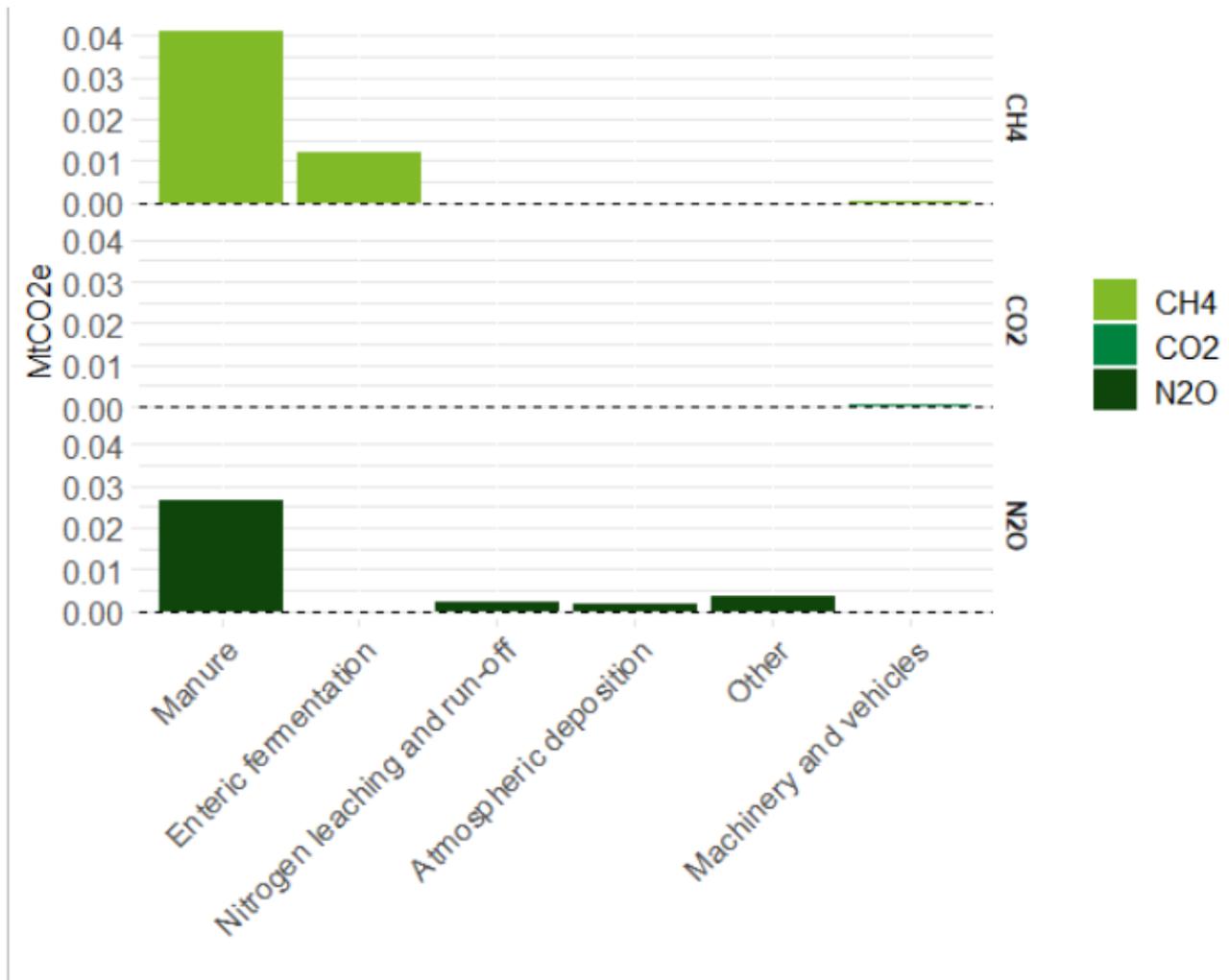
Emissions of both CH₄ and N₂O have reduced by around 35%. CH₄ emissions come from manure management and enteric fermentation, and N₂O emissions come from atmospheric deposition, fertiliser, manure management, nitrogen leaching and run-off, and urine and dung.

Sources

The chart below shows how the 2018 emissions from pigs break down by source and pollutant. Manure management is the largest source contributing 72% of pig emissions with the majority coming from CH₄. The next largest source, contributing a further 14%, is enteric fermentation.

Emissions from Pigs by source and pollutant, 2018

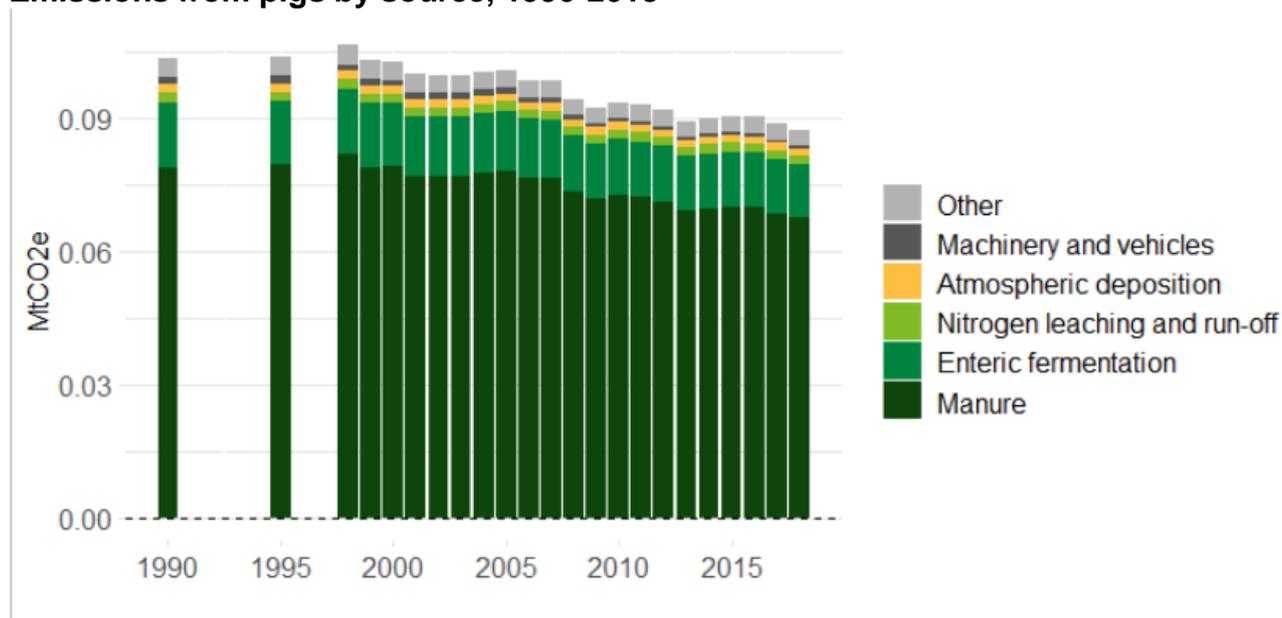
² Scottish agriculture tables - economic report: 2020 edition - gov.scot (www.gov.scot)



Source: [Scottish Greenhouse Gas Emissions 2018 - gov.scot](http://gov.scot)
www.gov.scot

Over time, the largest reduction by source has come from a reduction in total emissions from manure management. Most other sources have shown only small change since 1990, though there has been a small increase in emissions from urine and dung from grazing.

Emissions from pigs by source, 1990-2018



Source: [Scottish Greenhouse Gas Emissions 2018 - gov.scot](https://www.gov.scot/publications/scottish-greenhouse-gas-emissions-2018/pages/10.aspx)
(www.gov.scot)

Potential Savings

Research undertaken by CXC and SRUC on behalf of Scottish Government assessed the potential savings from a range of mitigation measures that could be applied in Scotland and the likely maximum uptake that could be achieved. The report did not assess timescales for uptake of these measures, which will be influenced heavily by factors such as behaviour change and policies. The table below summarises the two measures that could be applied to pigs. Estimates of the aggregate emissions savings have been added based on most recent data on numbers of pigs, around 319,000 in 2019 .

Sources of climate change mitigation in the pig sector

Mitigation measure	Maximum uptake 2050	Per unit mitigation (kg CO ₂ e)	Aggregate Mitigation (MtCO ₂ e)
Precision feeding of livestock	90%	25	0.006
Impermeable slurry store covers	26%	86	0.006
Additive total	..	111	0.012

Source: [Marginal abatement cost curve for Scottish agriculture](https://www.climateexchange.org.uk/marginal-abatement-cost-curve-for-scottish-agriculture)
([climateexchange.org.uk](https://www.climateexchange.org.uk))

Strictly speaking the 'additive totals' overstate the savings as some measures may interact and reduce the impact of other measures. However these interactions were assessed to be relatively low.

If each of these measures were applied to their maximum potential as identified in the report, estimated reductions from emissions based on pig numbers would be in the region of 0.012 MtCO₂e. This would be a reduction of around 13% of emissions from the pig sector, or 0.5% of the 2.4 MtCO₂e reductions required by agriculture by 2032. This would fall short of the 31% reduction in GHG emissions needed from agriculture as a whole.

It is important to note that the figures above are average estimates that were provided for Scotland as a whole. Further, on an individual farm basis, both the mitigation and the net costs (below) can be very different and some measures above cover a wide range of possible actions which would be demanding to assess individually. Therefore the GHG benefits achieved and costs could vary widely.

Further details on each of these measures, such as costs, underpinning assumptions, constraints and potential uptake can be found in the Annexes to the CXC on pages 43-53.

As set out within the CCC report, there is scope for all sectors in agriculture to mitigate their operational GHG emissions through other practises and alternative land use such as those to encourage carbon sequestration.

However, precise estimate and demonstration of the sector’s scope/ability to do this is limited. Likewise, as also set out within the CCC report, wider changes may be needed to meet the targets, including changes in farming practices and changes to consumer diets.

Costs

Some of these measures would involve the purchase of capital equipment with upfront costs. The table below shows the net costs to farmers including capital costs on an average annual basis. These do not include any wider costs such as those to Government or Research and Development from developing measures. Negative figures below show a net saving to the farmer, i.e. if implemented they would provide a financial saving to the farmer as well as a reduction in emissions. Based on current pig levels the average potential saving to the sector is around £0.16m.

Sources of climate change mitigation in the pig sector

Mitigation measure	Per unit annualised cost (£)	Aggregate Cost (£m)
Precision feeding of livestock	-0.87	-0.19
Impermeable slurry store covers	0.52	0.03
Additive Total		-0.16

Source: [Marginal abatement cost curve for Scottish agriculture \(climatexchange.org.uk\)](https://climatexchange.org.uk)

Current Uptake & Implementation Constraints

This section contains a brief summary of some of the key issues relating to each of the measures outlined in the tables above, drawing heavily on the CXC report.

Precision feeding of livestock

Precision feeding is primarily applicable to housed animals that can be monitored at regular intervals, with that information used to adjust rations. For pigs, this may involve regular weighing of animals and adjustment based on weight and growth, and supplementation with amino acids.

Phase feeding is believed to be implemented widely in the pig industry, and the improvement is expected to be a shift to multiphase feeding. Installation costs are high, meaning large units are seen as more likely to implement these systems; since Scottish pig production is concentrated in large units, potential uptake is high.

Impermeable slurry store covers

Covers can include floating, rigid, natural crust and suspended covers. Covers can reduce ammonia emissions, thereby reducing indirect nitrous oxide emissions, and increases the fertiliser value of the slurry, though there is a risk for higher losses when slurry is applied unless low-ammonia emission techniques are implemented.

Slurry covers can be installed on all slurry tanks and lagoons and costs are relatively low. However, some types of cover are not yet well tested for durability, and build ups of methane under covers can pose a risk unless additional devices are used.

Annex – GHG Inventory Assumptions

Sources in the inventory have been attributed based on the following percentages:

Table C1. Emission source attribution

IPCC	Source Name	Crops	Dairy	Deer	Goats	Horses	Beef	Pigs	Poultry	Sheep
3D11_Inorganic_nitrogen_fertilizers	Grass - Direct		30%				60%			10%
3D14_Crop_residues	Grass - Direct		30%				60%			10%
3H_Urea_application	Fertiliser Application	80%	10%				10%			
1A4cii_Agriculture/Forestry/Fishing:Off-road	Agriculture - mobile machinery	60%	20%				20%			
3A4_Enteric_Fermentation_other_livestock	Enteric			7%	1%	67%		25%		
3G1_Liming - limestone	Liming	50%	15%				30%			5%
3G2_Liming - dolomite	Liming	50%	15%				30%			5%

Other livestock includes emissions from deer, goats, horses, pigs, poultry, and other livestock. This results in the following estimates of GHG emissions for agriculture in 2018:

Table C2. Estimates of GHG emissions for agriculture, 2018

Agricultural Sector	Emissions Inventory MtCO ₂ e	in Attributed on expert input MtCO ₂ e	based Proportion attributed %
Beef	2.97	0.47	16
Arable/Crops	1.02	0.59	58
Dairy	0.86	0.31	36
Sheep	0.99	0.05	5
Other livestock	0.20	.. ³	..
-- Of which pigs	0.09
Uncategorised	0.02

In 2018, emissions from other livestock were:

³ Due to the approach taken in assigning emissions, emissions from Other livestock were not attributed. Some pig emissions could be attributed, with a very small increase in pig emissions as a result.

Table C3. Estimates of GHG emissions from other livestock, 2018

Other livestock	MtCO₂e	As % of Other livestock emissions	As % of Agriculture emissions
Pigs	0.0863	43%	1.16%
Other livestock	0.0486	24%	0.65%
Poultry	0.0414	20%	0.55%
Horses	0.0249	12%	0.33%
Deer	0.0007	0%	0.01%
Goats	0.0004	0%	0.01%



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