Regional challenges to the UK sheep sector (**including impacts on Greenhouse Gas emissions from sheep systems)**

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@AgusBC3

With help from BC3, Phil Stocker (NSA), Cled Thomas (EEAP) and Georgios Arsenos (AUTH)

Innovations to improve sustainability in the sheep and goat sector.
An iSAGE training course and an iSAGE workshop.
Wood Hall Hotel & Spa, Linton, Wetherby, West Yorkshire, UK

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Joint Meeting FAO-CIHEAM Networks on Sheep and Goats and Mediterranean Pastures

Achieving net zero emissions by 2050 (or before)

Climate Change (Emissions Targets) Bill

A

BILL

To Amend the Climate Change Act 2008 to require net United Kingdom carbon emissions to be zero by 2050 and to include international aviation and international shipping in the calculation of such emissions.

Presented by Rachel Reeves
supported by
Mary Creagh, Edward Miliband,
Drew Hendry, Norman Lamb,
Caroline Lucas, Nicky Morgan,
Peter Kyle, Zac Goldsmith,
Anna McMorrin, Antoinette Sandbach
and Dr Sarah Wollaston.

Ordered, by The House of Commons,
to be Printed, 11th June 2019.

PUBLISHED BY AUTHORITY OF THE HOUSE OF COMMONS

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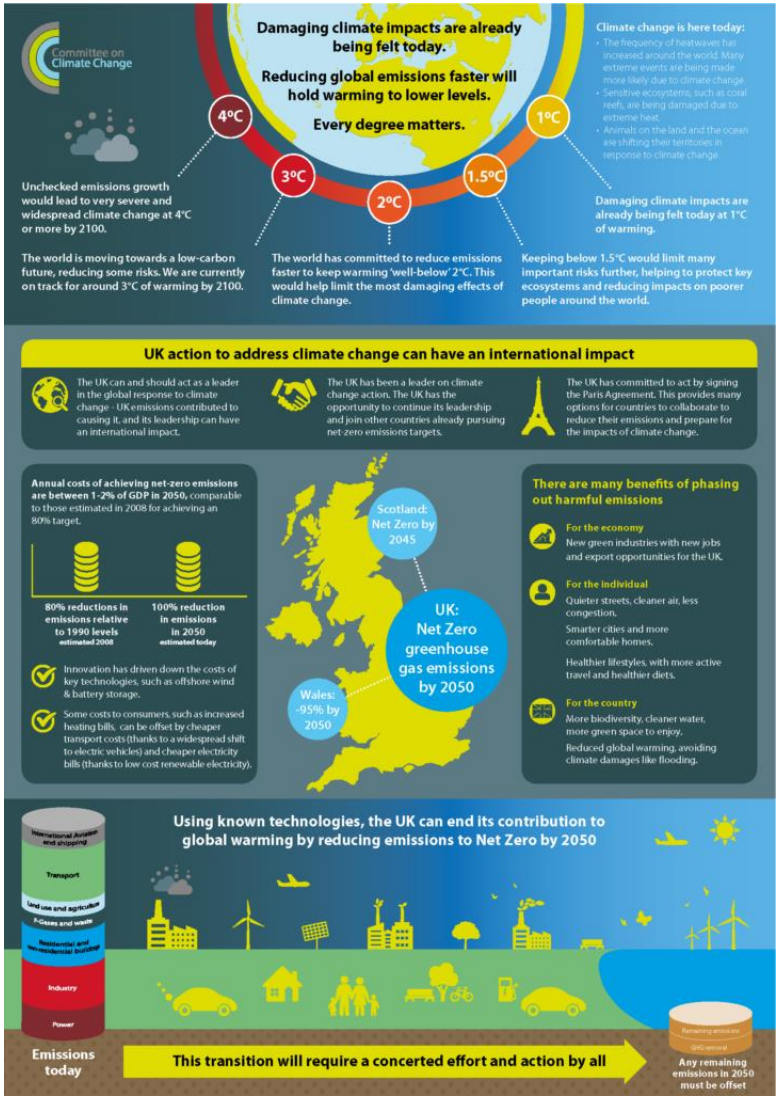
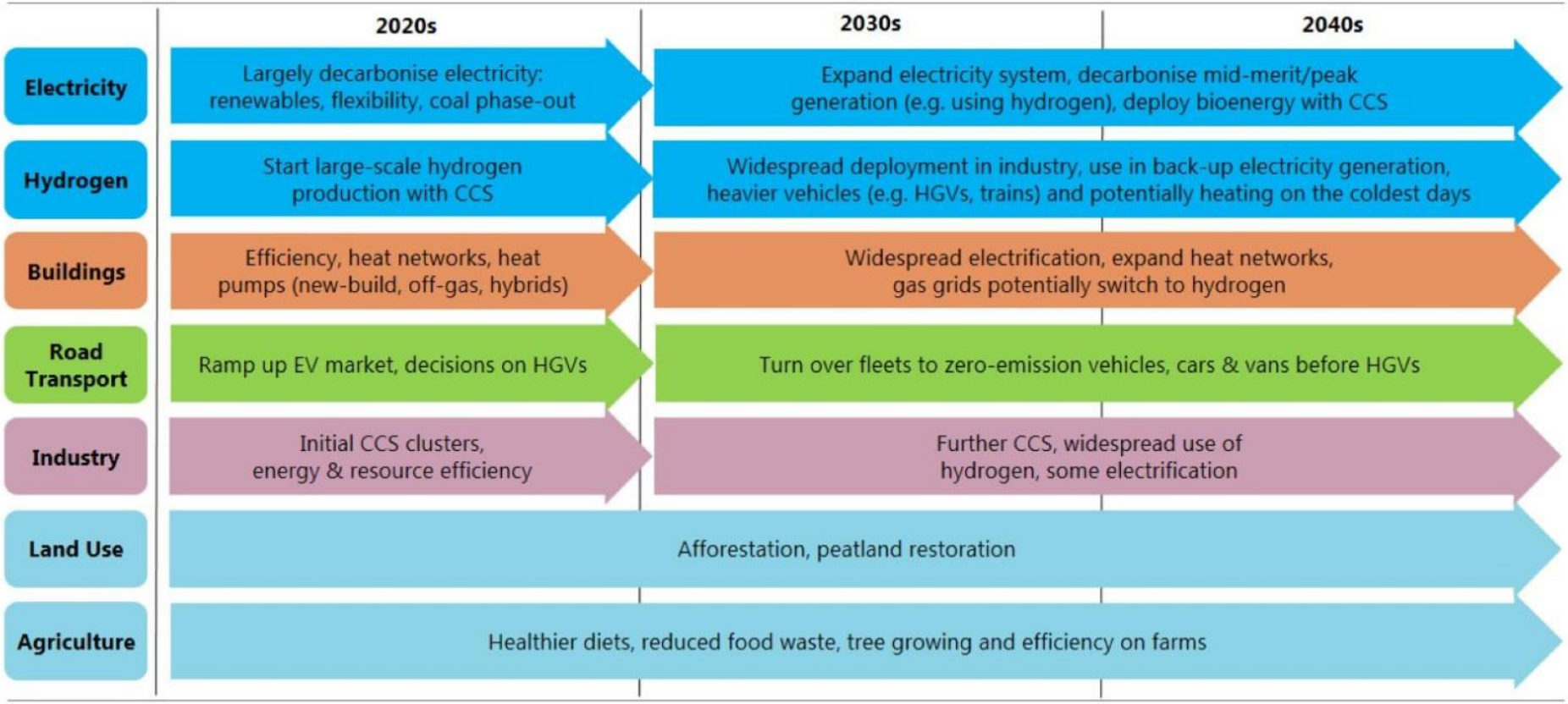
Achieving net zero emissions by 2050 (or before)



Committee on Climate Change

Reaching net-zero emissions in the UK
How UK net-zero scenarios can be delivered



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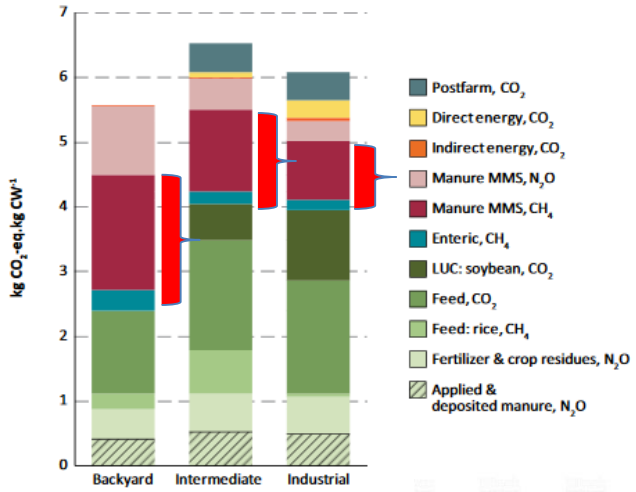
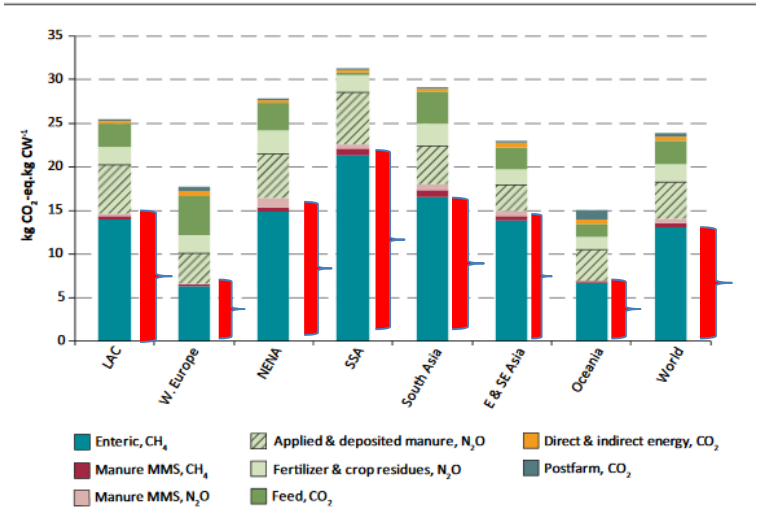
Methane-the evil



Source: FAO



Source: FAO

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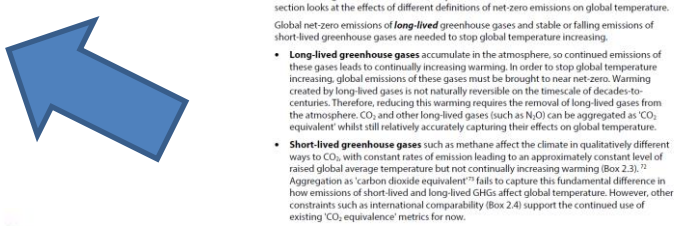
Is it sensible to consider all GHG together?

"To stabilise global temperatures, emissions of long-lived gases like CO2 must be reduced to net-zero. **Emissions of short-lived gases like methane must be stabilised, but need not reach net-zero**".



4. Defining 'net-zero' emissions

A net-zero target could be set for CO_2 only or could include emissions of additional GHGs. This section looks at the effects of different definitions of net-zero emissions on global temperature.

Global net-zero emissions of ***long-lived*** greenhouse gases and stable or falling emissions of short-lived greenhouse gases are needed to stop global temperature increasing.

- **Long-lived greenhouse gases** accumulate in the atmosphere, so continued emissions of these gases leads to continually increasing warming. In order to stop global temperature increasing, global emissions of these gases must be brought to near net-zero. Warming created by long-lived gases is not naturally reversible on the timescale of decades-to-centuries. Therefore, reducing this warming requires the removal of long-lived gases from the atmosphere. CO_2 and other long-lived gases (such as N_2O) can be aggregated as 'CO_2 equivalent' whilst still relatively accurately capturing their effects on global temperature.
- **Short-lived greenhouse gases** such as methane affect the climate in qualitatively different ways to CO_2, with constant rates of emission leading to an approximately constant level of raised global average temperature but not continually increasing warming (Box 2.3).[72] Aggregation as 'carbon dioxide equivalent'[73] fails to capture this fundamental difference in how emissions of short-lived and long-lived GHGs affect global temperature. However, other constraints such as international comparability (Box 2.4) support the continued use of existing 'CO_2 equivalence' metrics for now.

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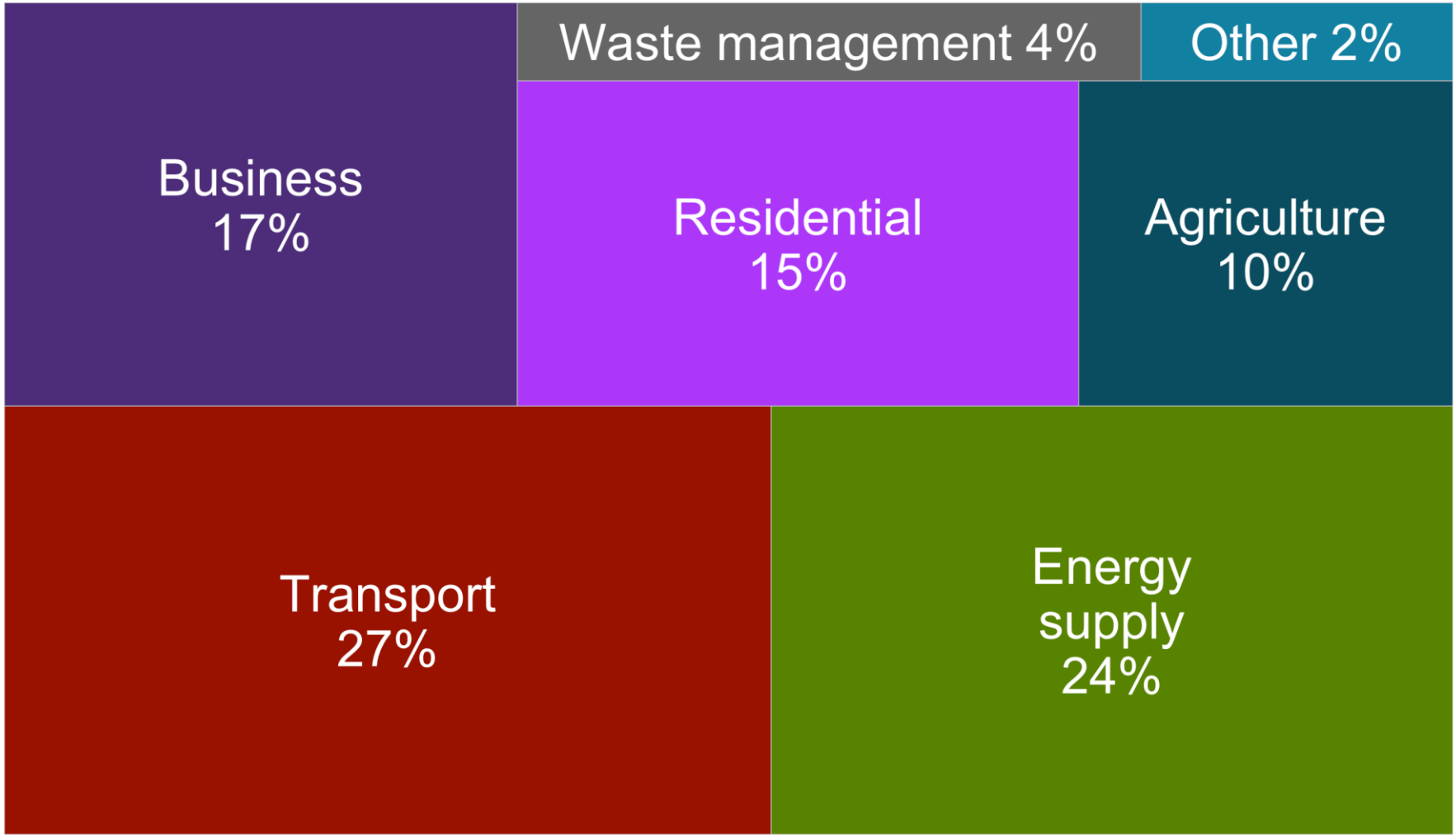
Transport was the largest emitting sector of greenhouse gases in 2017

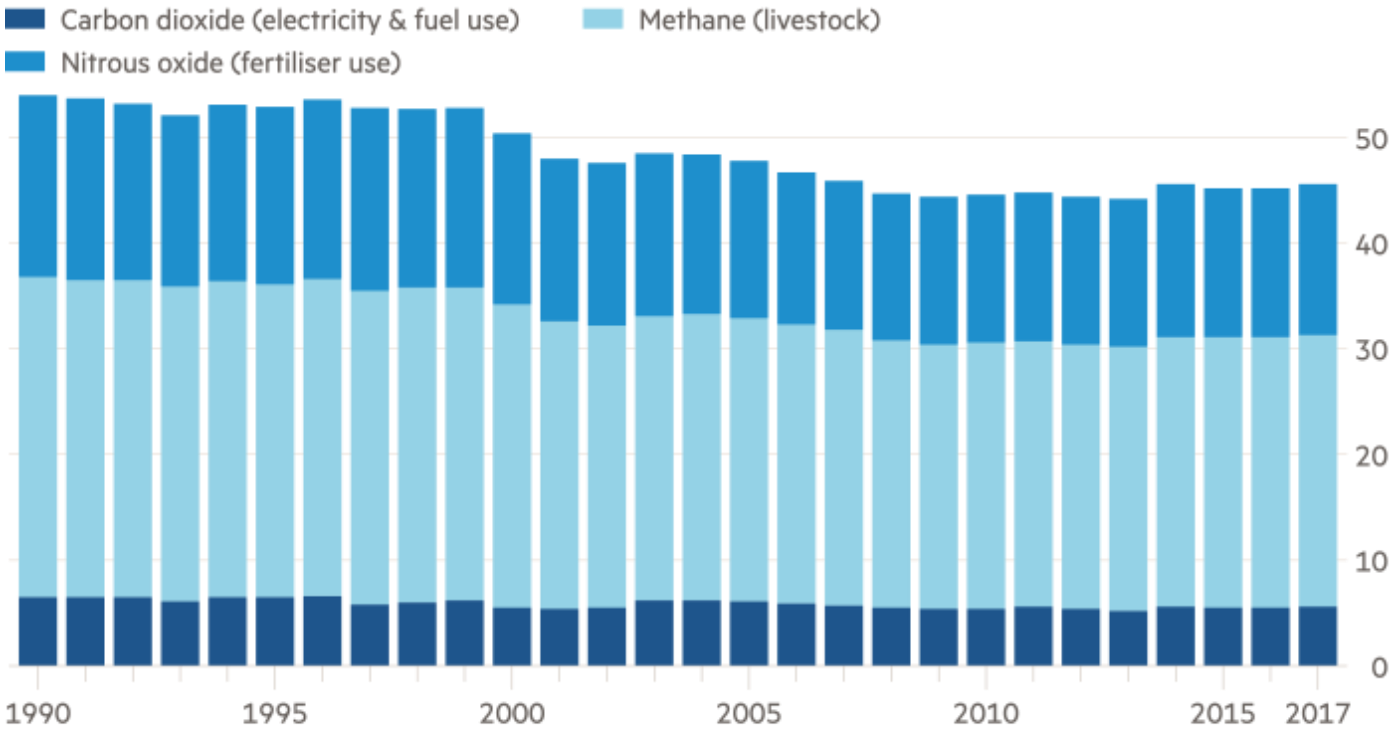


Source: Department for Business. Does not add up to 100% due to rounding.

BBC

Methane makes up large share of agricultural sector emissions

UK greenhouse gas emissions, metric tons of CO2 equivalent



Source: Department for Business, Energy & Industrial Strategy

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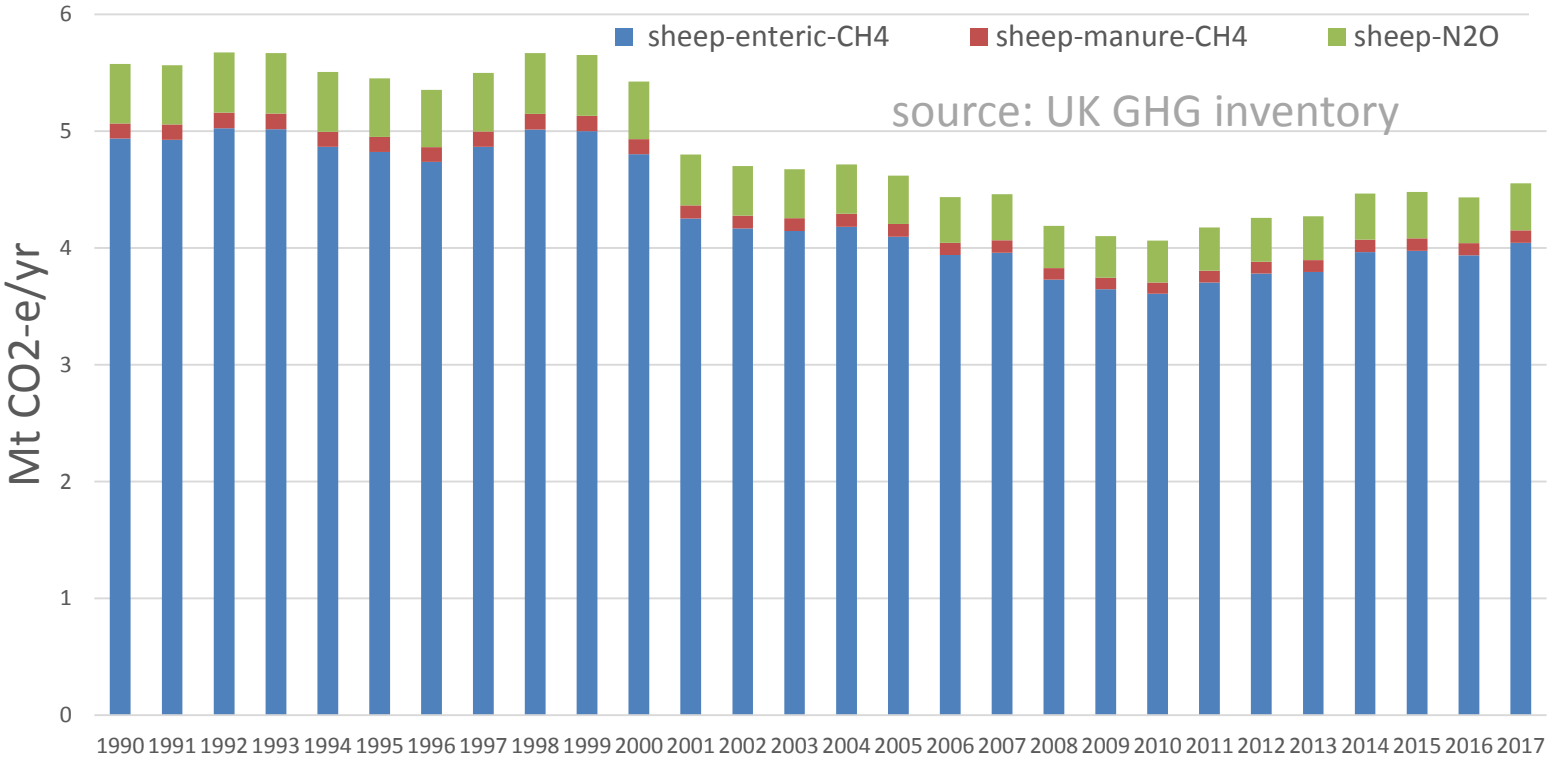
GHG emissions from UK Sheep



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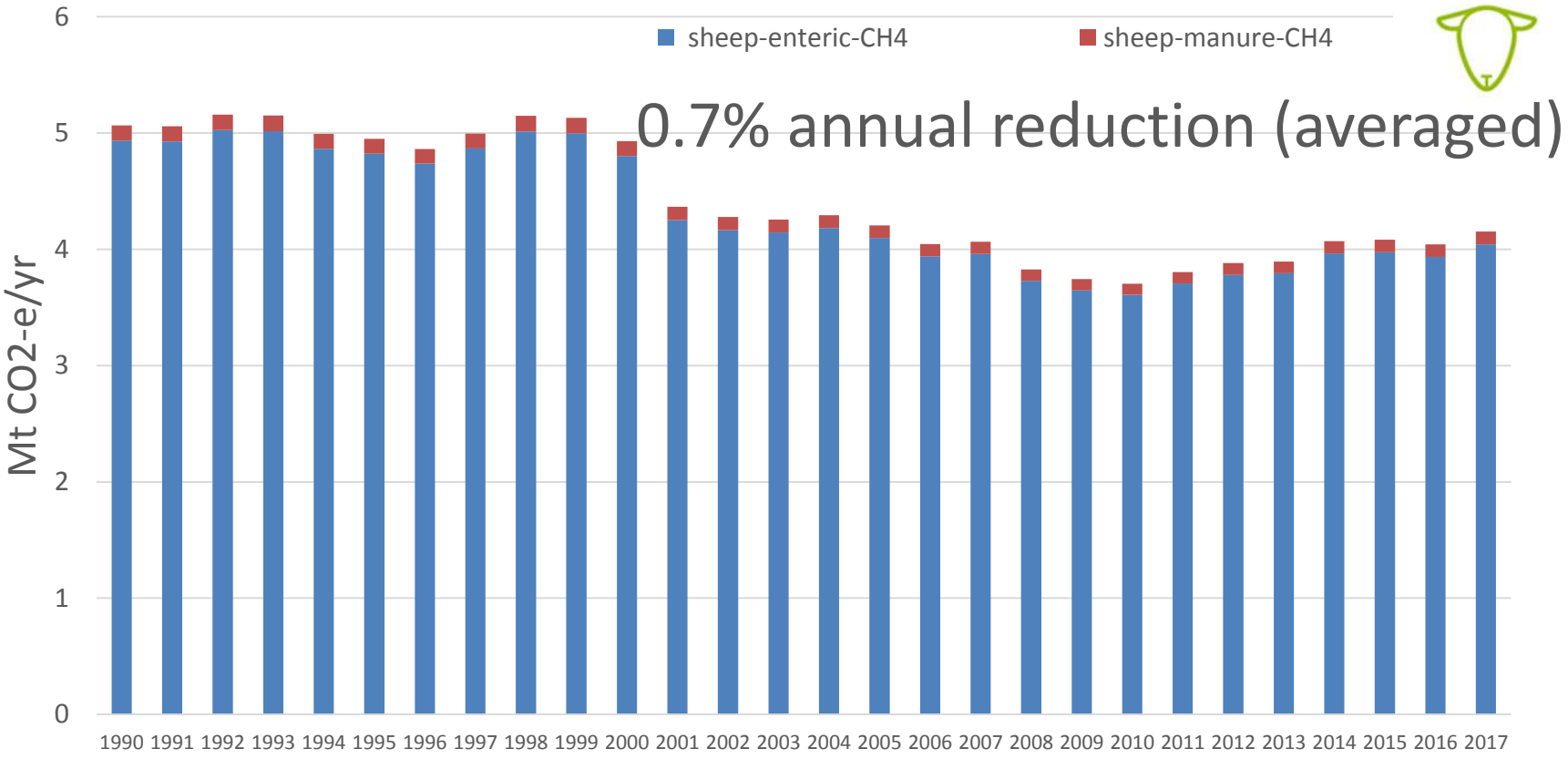
CH4 emissions from UK Sheep



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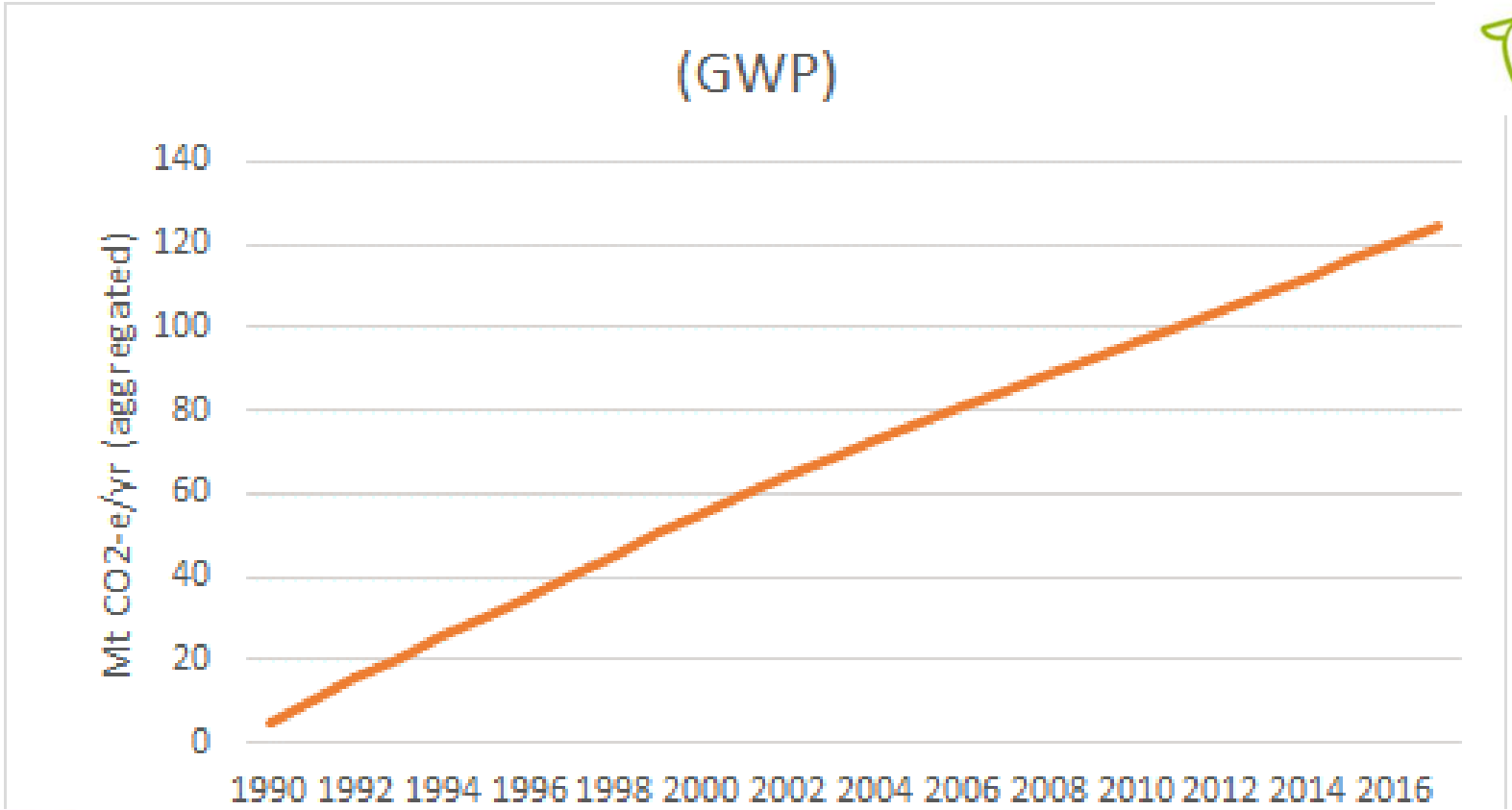
Aggregated CH_4 from sheep (GWP)



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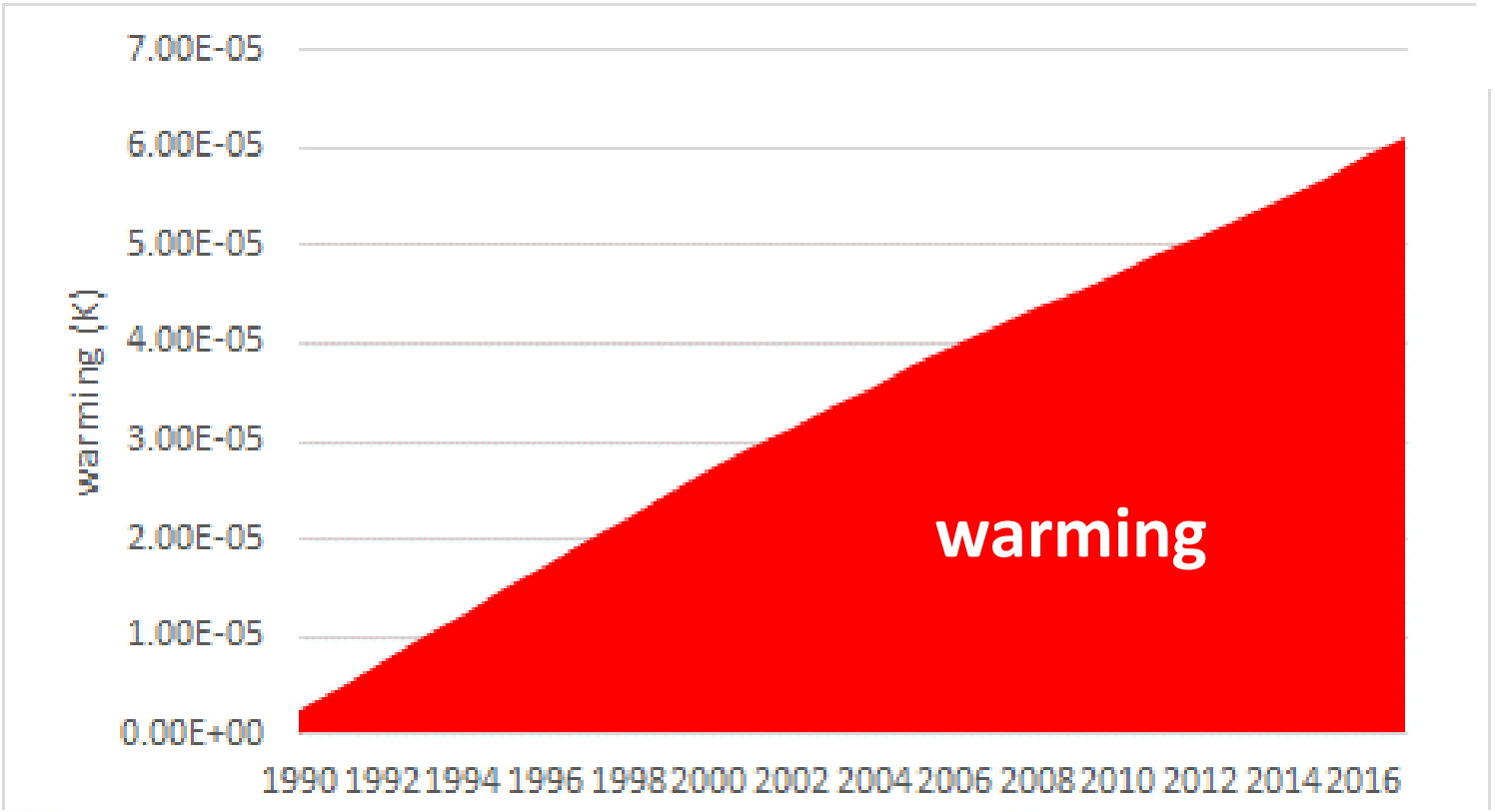
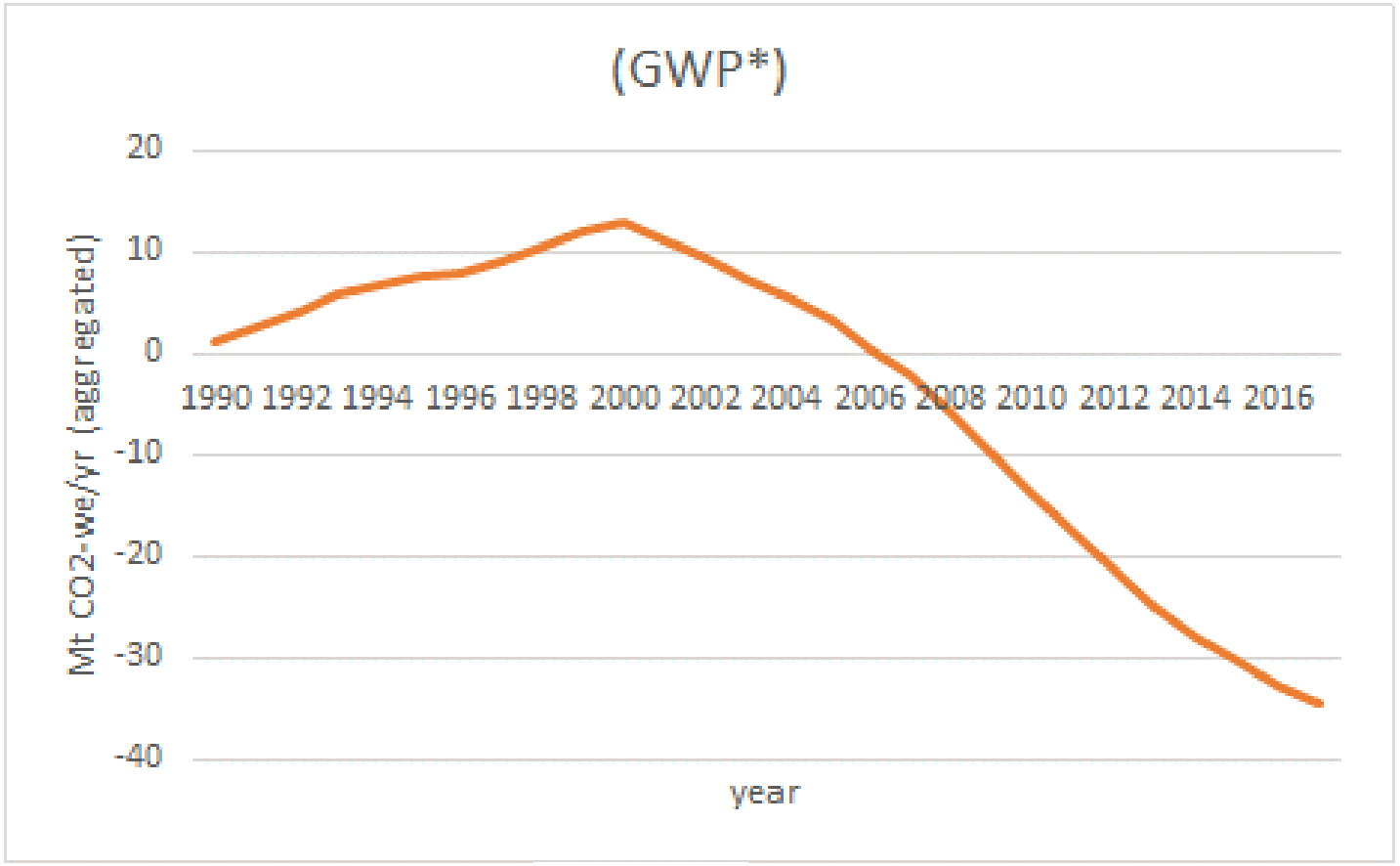
Warming effect by UK sheep (GWP)

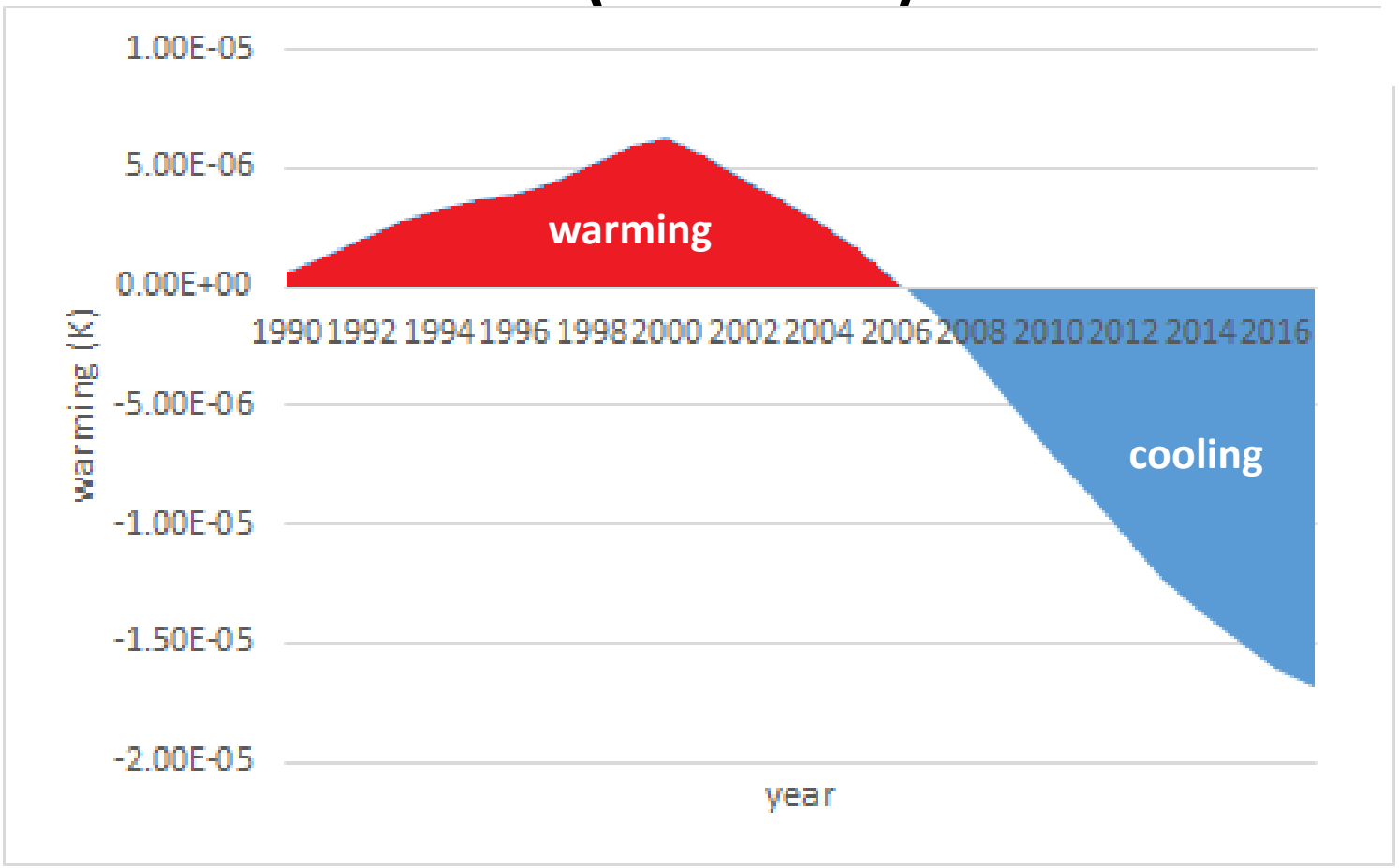


Aggregated CH4 from sheep (GWP*)



Based on Cain et al. (2019)

Aggregated CH4 from sheep (GWP*)

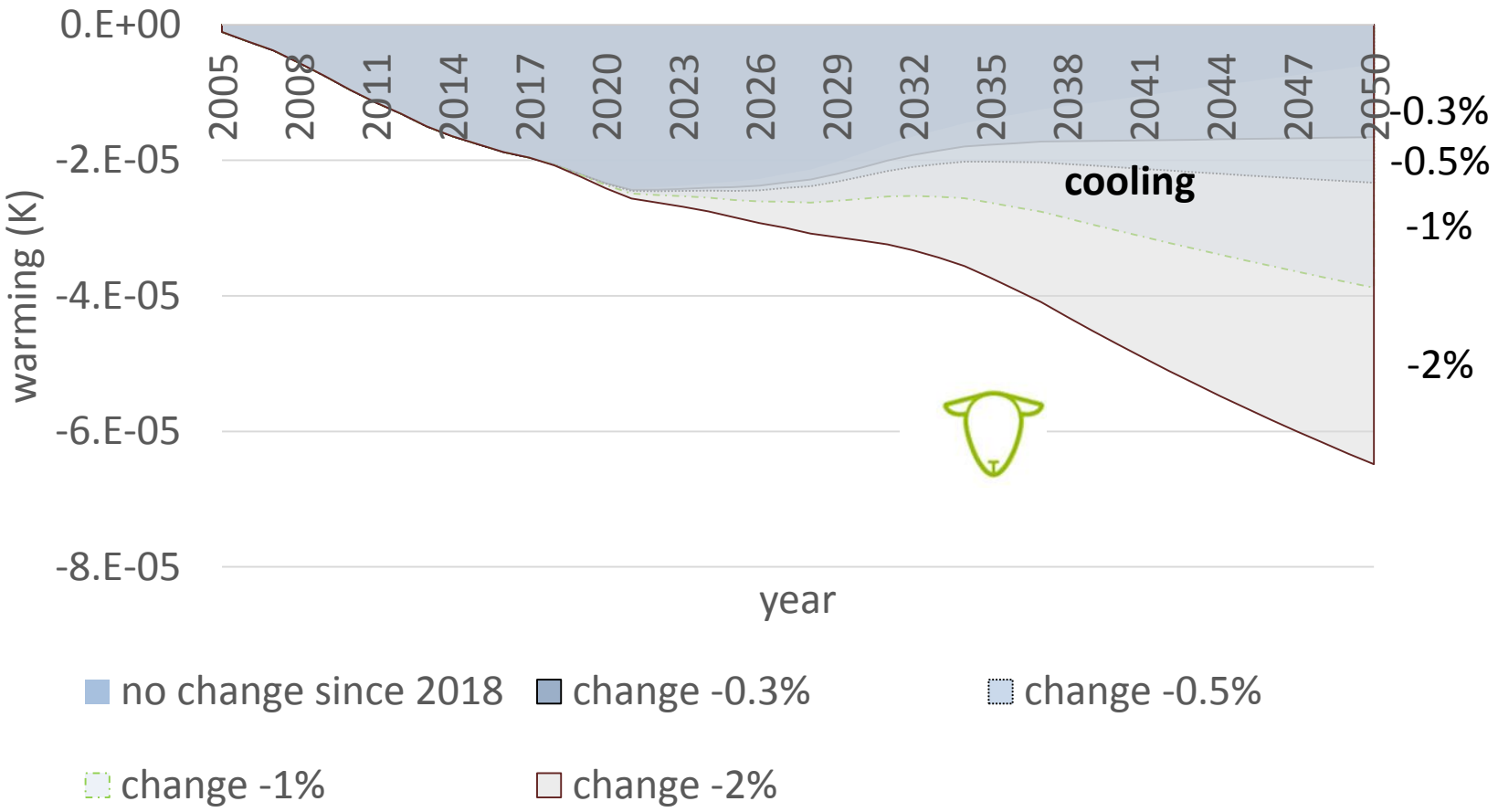


Based on Cain et al. (2019)

Potential pathways for biogenic sheep CH_4 in the UK

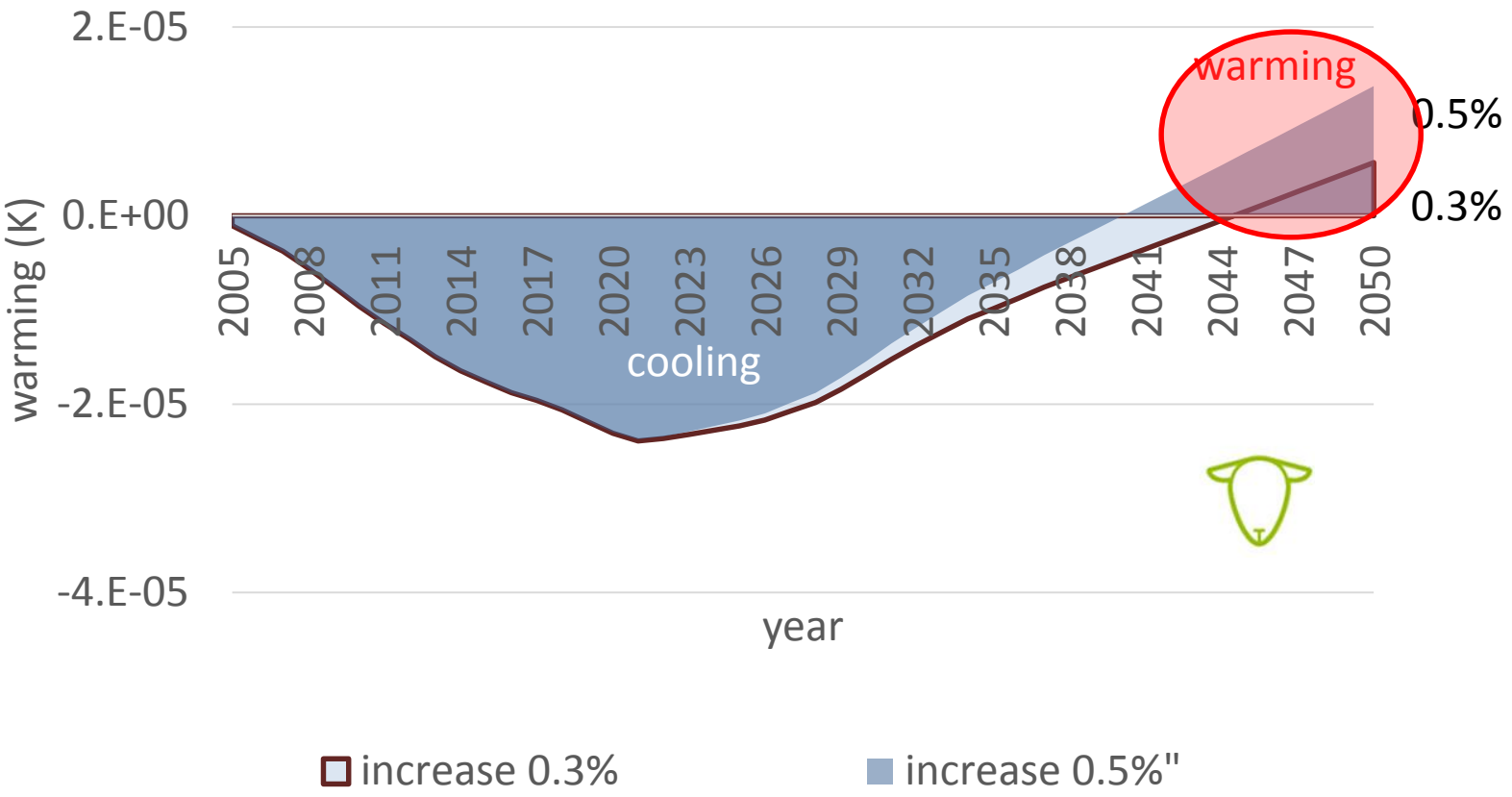
SCENARIOS	Annual reduction	Short-term reduction in period (2005-2030)	Medium-term reduction in period (2005-2050)
No change (2018-)	0%	0%	0%
Small reduction	0.3%	5%	11%
Medium reduction	0.5%	7%	16%
Ambitious reduction	1%	13%	29%
Very ambitious reduction	2%	24%	49%
Small increase	-0.3%	3%	9%
Medium increase	-0.5%	5%	16%

Warming effect: Pathways with CH_4 reduction



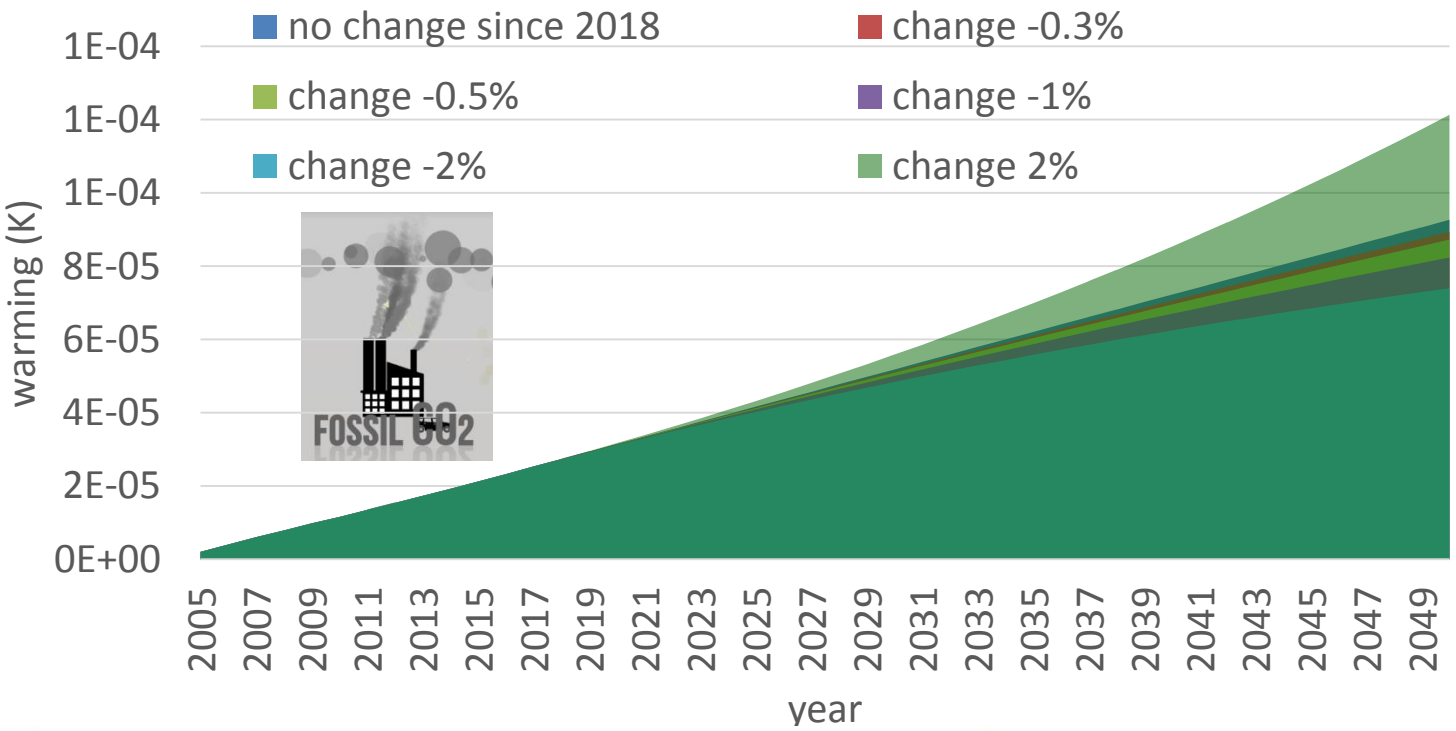
Based on Cain et al. (2019)

Warming effect: Pathways with CH_4 increase



Based on Cain et al. (2019)

Warming effect: if Pathways were refered to fosil CO_2 emissions



Warming!!

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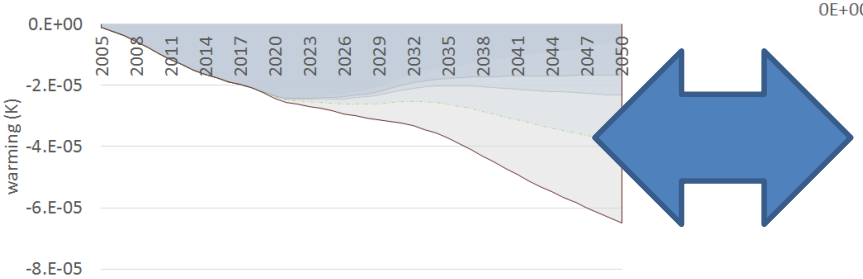
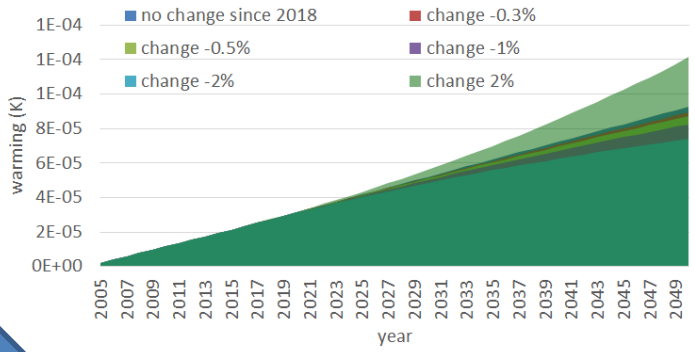
Warming effect: if Pathways were refered to fosil CO_2 emissions

Cooling!!





Warming!!

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Novel mitigation measures (CH_4)

*In vitro (*Kinley et al., 2016; Vucko et al., 2017; Maia et al., 2017)
In vivo: UC Davis (US)

Holstein cows feeding at a dairy farm in Merced, California. MARMADUKE ST. JOHN / ALAMY

How Eating Seaweed Can Help Cows to Belch Less Methane

3-nitrooxypropanol (NOP)

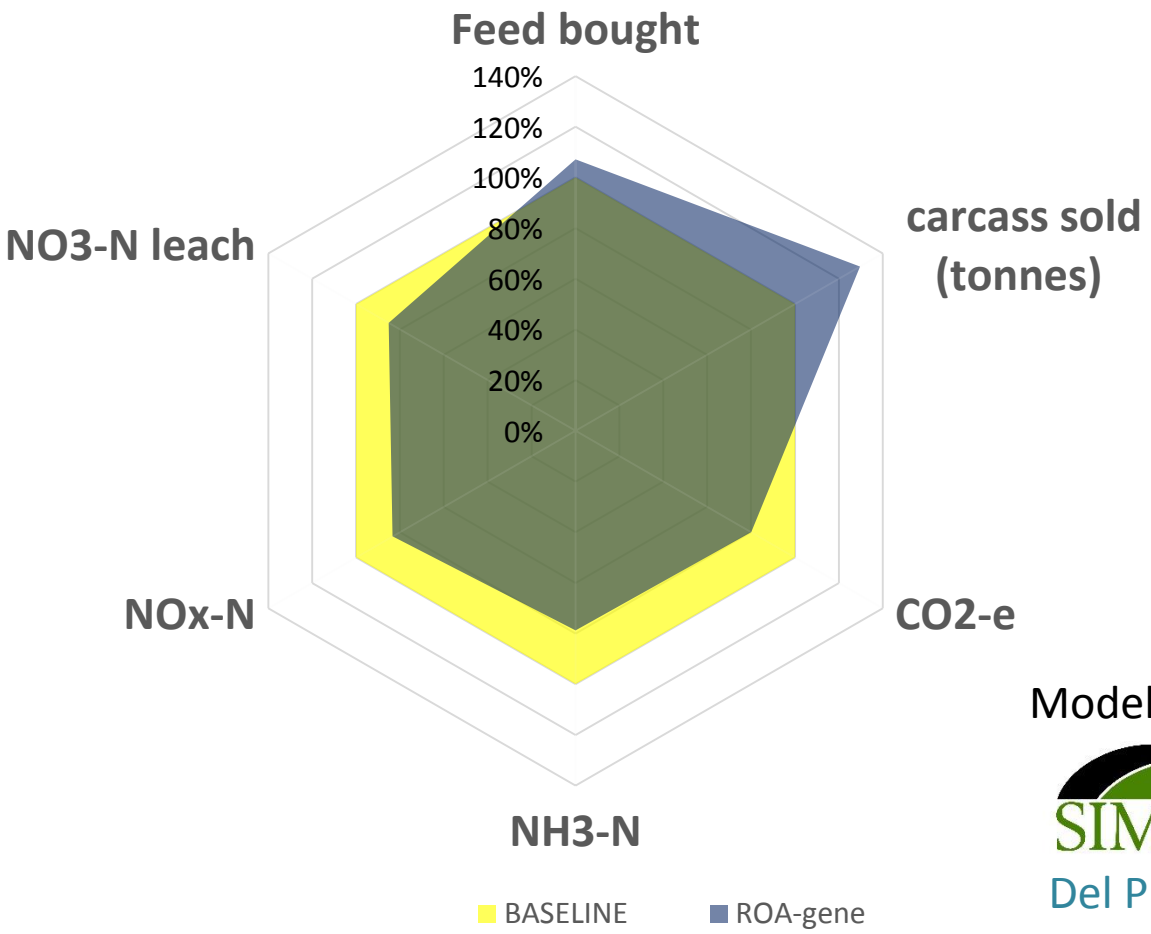
Antiburp compound could reduce methane emissions from cows

Duin *et al*. (2016) Proc Natl Acad Sci 31;113(22):6172-7

	Martinez-Fernandez et al. (2013)	Haisan et al. (2014)	Haisan et al. (2013)	Reynolds et al. (2014)	Romero Perez et al. (2014)
Location of study	Spain	Alberta	Alberta	UK	Alberta
Animals	sheep	dairy cows	dairy cows	dairy cows	beef cattle
Dietary forage, % DM	60	40	60	52	60
NOP dose, g/d	0.1	2.5	1.25, 2.5	0.5, 2.5	0.5, 1.4, 2.8
Method of NOP supplementation	2×day pulse dose	mixed into diet	mixed into diet	2×day pulse dose	top dressed onto TMR
% CH_4 (g/kg DMI) reduction	25	60	35, 51	4, 7	4, 9, 33
% DMI reduction	0	0	0	0	2.5, 5.8, 5.0

DMI = dry matter intake

Innovations-ROA allele (increases prolificacy)



Modelled with SIMSSR

Del Prado *et al.* (2019)

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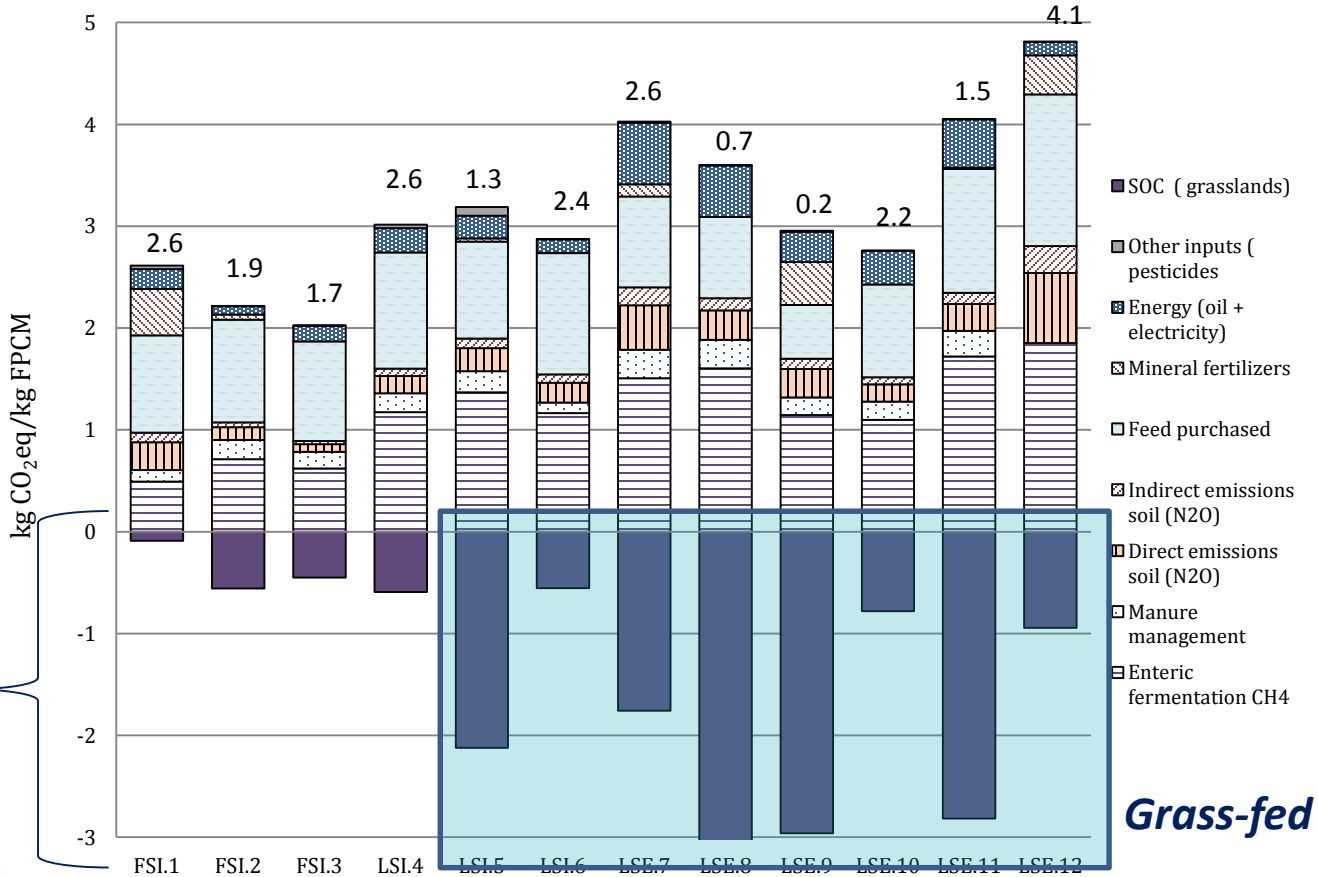
Important to include SOC sequestration



Carbon sequestration

Grass-fed sheep Systems

Batalla et al. (2015)

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However, these mitigation options should be accounted for in national inventories

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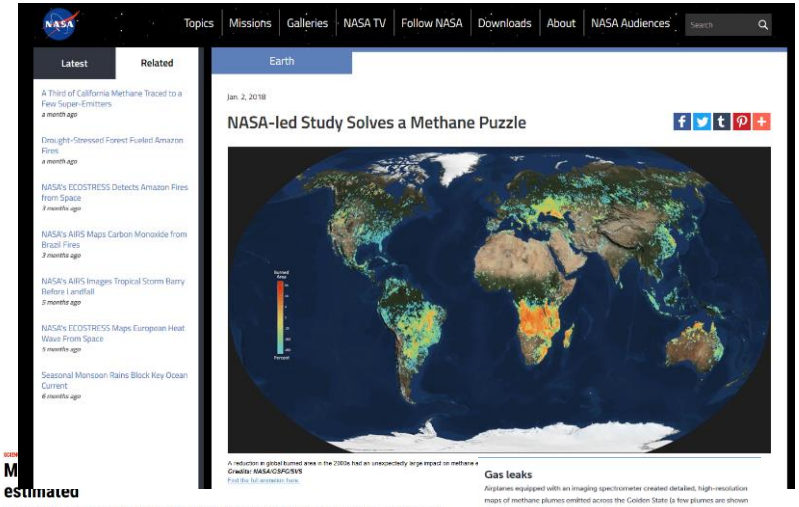
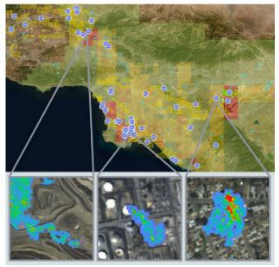
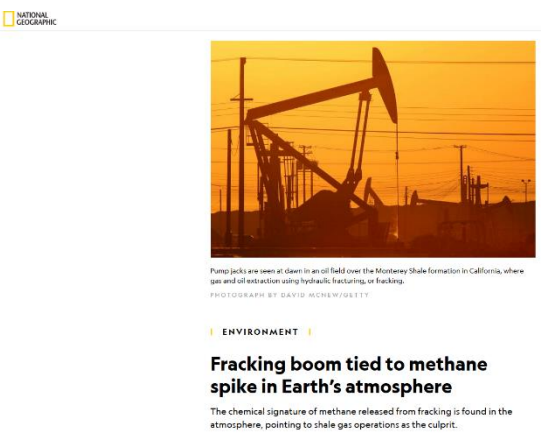
CH_4 uncertainties (other sources)

landfills





Leaky pipelines



Shale gas

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CH_4 uncertainties-sinks

Science of the Total Environment 607–608 (2017) 1163–1172

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Methane uptake in global forest and grassland soils from 1981 to 2010

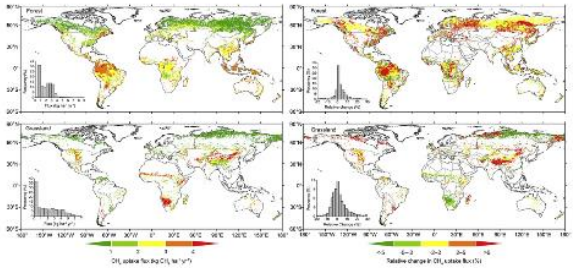
Lijun Yu [a], Yao Huang [b,*], Wen Zhang [a], Tingting Li [a], Wenjuan Sun [b]

[a] LAPC, Institute of Atmospheric Physics, University of Chinese Academy of Sciences, Beijing 100029, China
[b] State Key Laboratory of Vegetation and Environmental Change, Institute of Botany, University of Chinese Academy of Sciences, Beijing 100093, China

HIGHLIGHTS

- Empirical models were developed to estimate CH_4 uptake by forest and grassland soils.
- Global CH_4 uptake averaged 9.16 Tg/year and 3.73 Tg/year in forest and grassland soils during 1981–2010.
- CH_4 uptake in global forest and grassland soils increased slightly over the thirty years.

GRAPHICAL ABSTRACT



Aprox 4 Tg CH_4 yr^{-1} **uptake** in grassland soils during 1981-2010.
(This is aprox. 2% of all GHG livestock estimate from FAO, globally)

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Take homes

- Sheep and goats in the UK have caused no additional warming to the atmosphere
- Farmers can mitigate GHG with different interventions in the farm
- Main strategy should be to keep and move towards high Production standards

Thanks

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http://www.bc3research.org/en/agustin_del_prado.html
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