International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

The Updated Industrial Emissions Directive – *Effect on Ammonia Emissions*

Katrin Kaltenegger[1], Zbigniew Klimont[1]

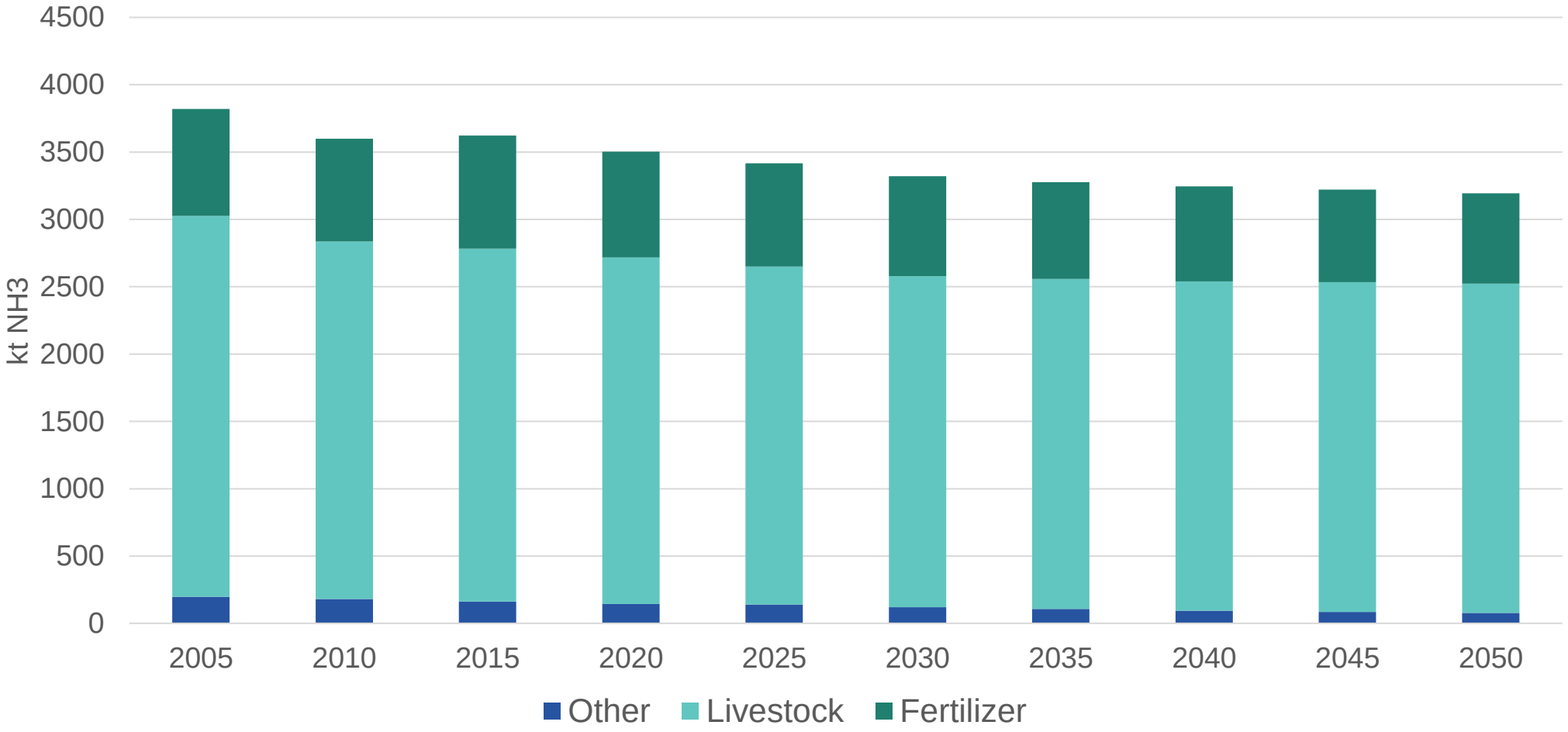
kalteneg@iiasa.ac.at

[1]International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria

Background

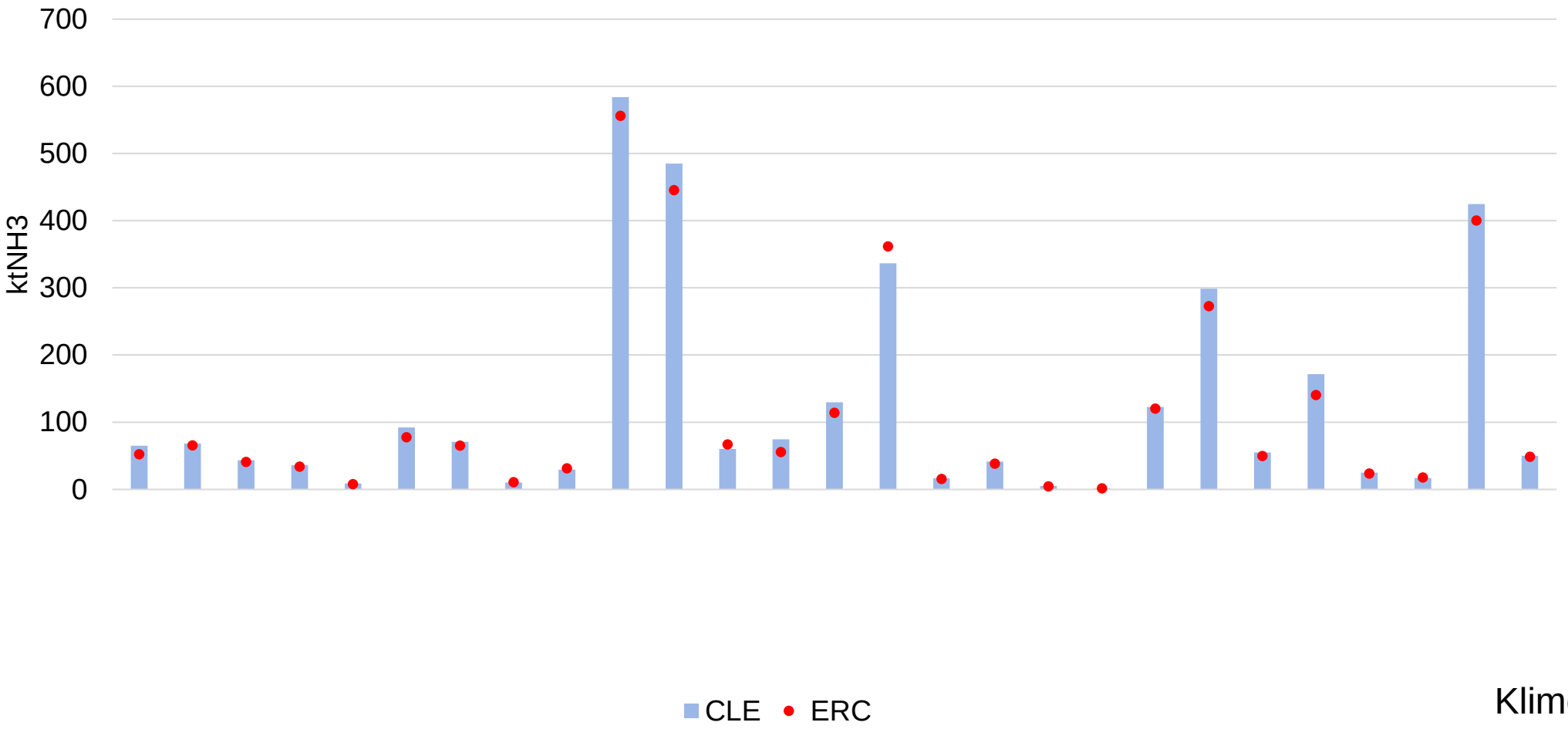
- Ammonia (NH_3) emissions
  - negatively affect ecosystem health (acidification and eutrophication)
  - impact human health through their contribution to $PM_{2.5}$ formation
- Emissions decrease little by 2050 across EU-27
- National Emission reduction Commitments (NEC) Directive targets in 2030 most likely not met

EU-27 NH_3 emissions by source



GAINS model results

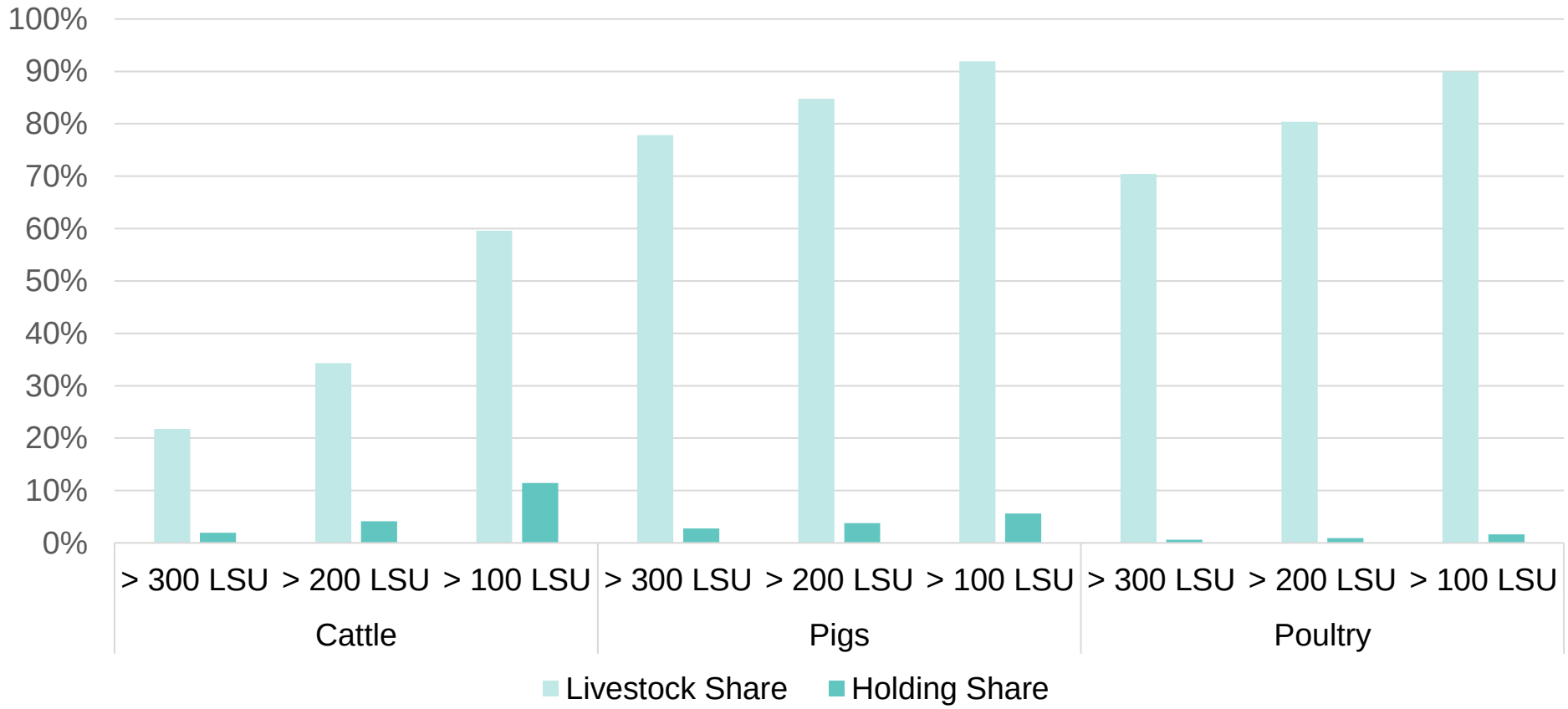
NH_3 emissions per country in 2030



Klimont et al. (2022)

CLE… current legislation emissions
ERC… emission reduction commitment

Farm structure in EU-27 in 2020



- 60-90% livestock on large farms (>100LSU)
- 2-10% of farms

EUROSTAT (2023)

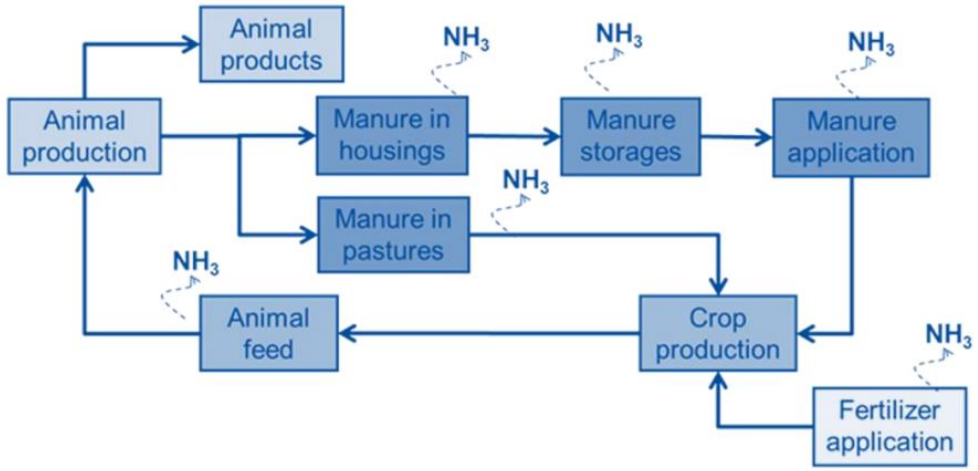
Updated Industrial Emissions Directive

- Permits required for cattle, pig and poultry farms > 150 LSU
- Emission limit values (ELVs) based on Best Available Technologies (BAT)
- New BATs by 2024
- First implementations of technologies by 2027

European Commission (2022)

GAINS emission calculation

- Emission factors per stage of manure management
  - Livestock, livestock management and country specific
- Stage and livestock management specific control strategies
- Country and technology specific applicabilities



Amann et al. (2011)

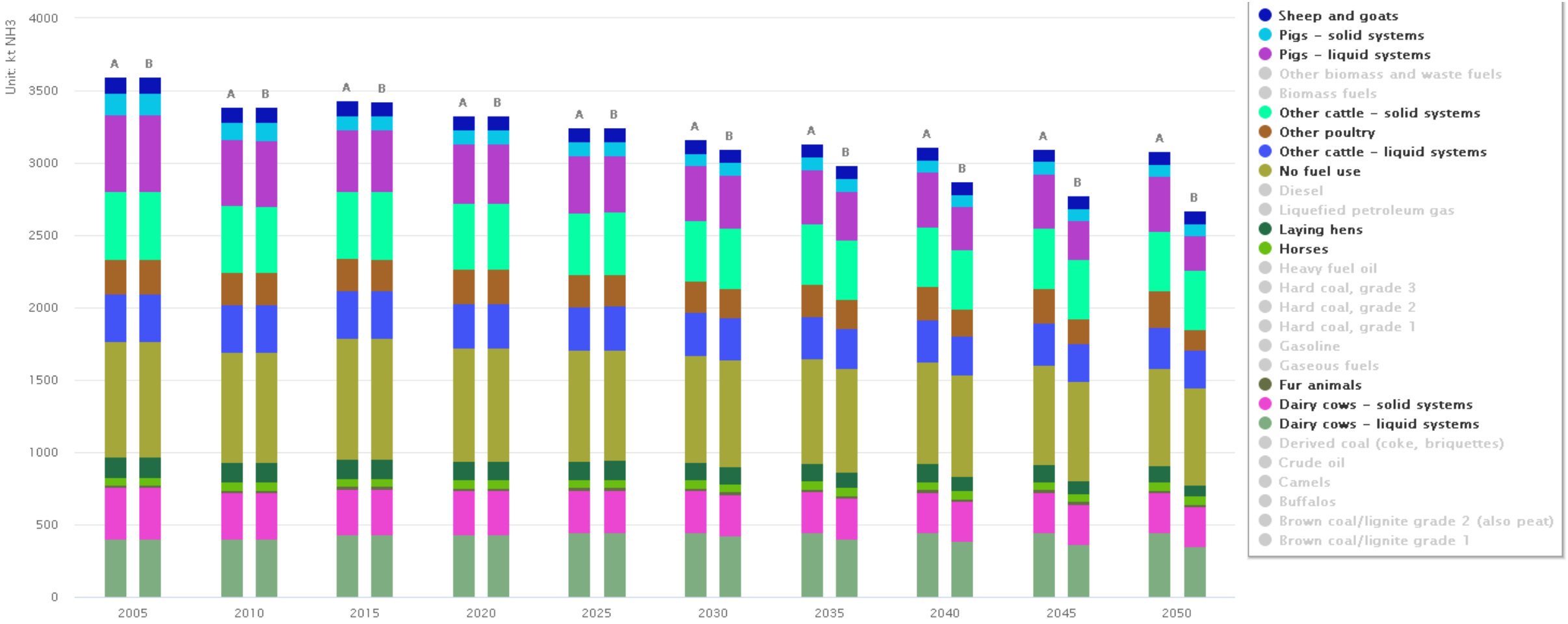
Implementing revised IED in GAINS

- Starting from 2027 with an increase in penetration until 2050
- On farms >150 LSU according to EUROSTAT farm structure survey extrapolation
- Combination of low nitrogen feed, covered storage and low nitrogen manure application transitioning to low emission housing
    - Can vary per country and livestock type depending on previous controls and applicability of new controls

NH_3 emission reduction options - BAT

Abatememt Option	Removal efficiency (%)			
	Housing	Storage	Application	Total
Covered storage; mean efficiency	0	70-80%	-5%	5-15%
Low N application; mean efficiency	0	0	60-80%	25-30%
Low N feed, covered storage, low N application	10-20%	75-80%	60-80%	40-50%
Low N feed, housing adaptation, low N application	35-85%	80%	60%	60-80%

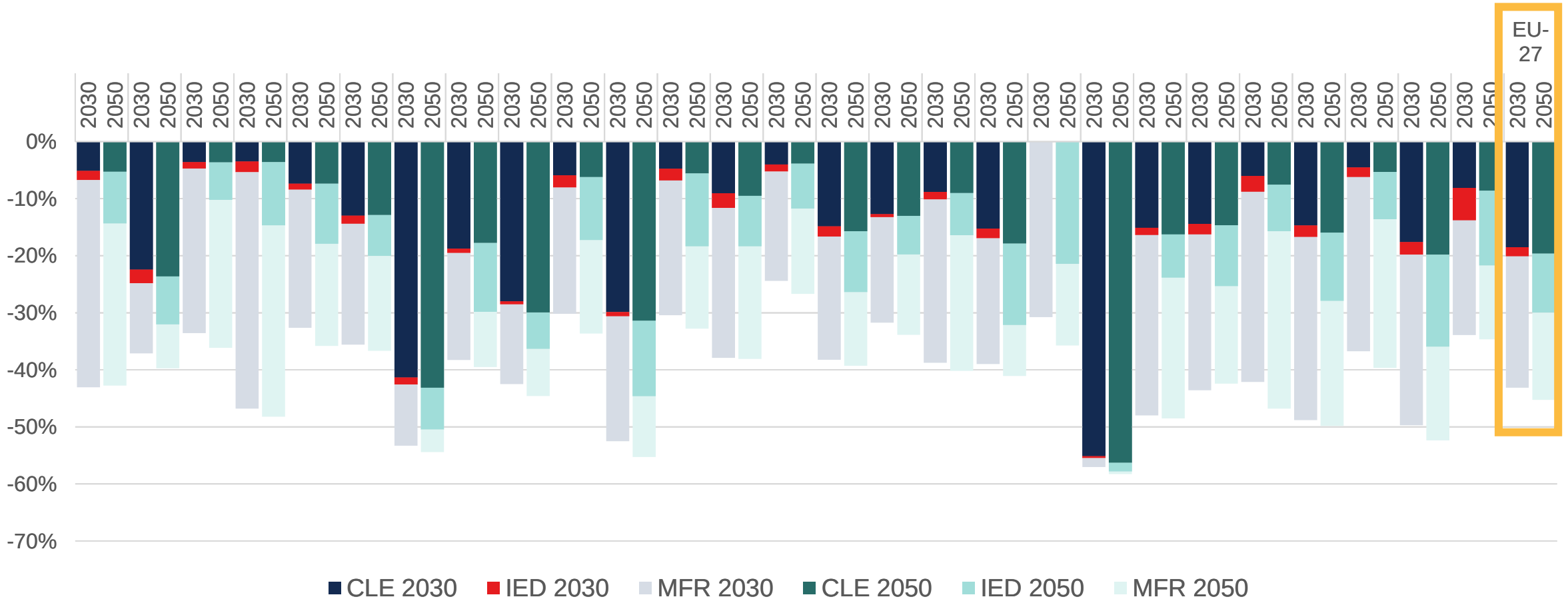
NH3 emissions EU-27 – CLE and revised IED

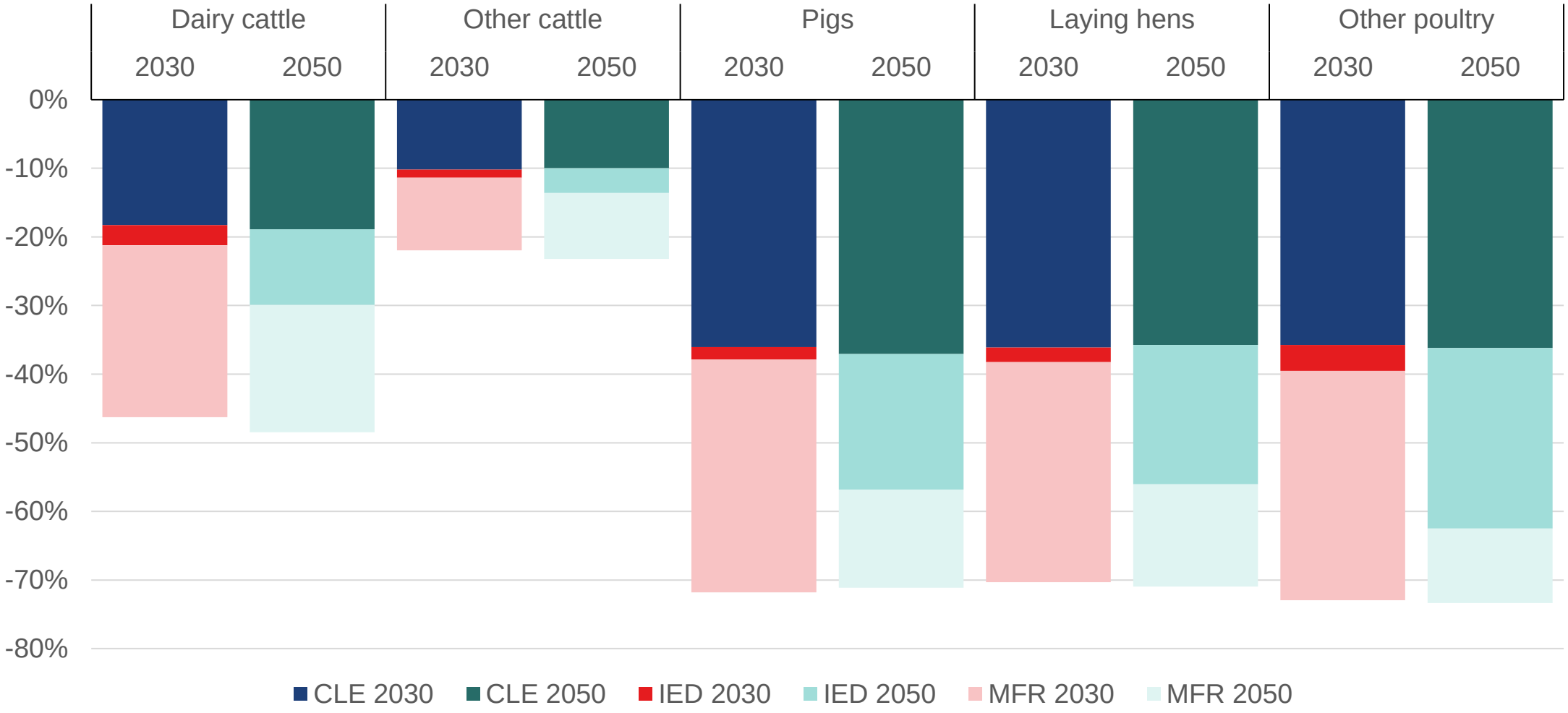


2030: -3%

2050: -16%

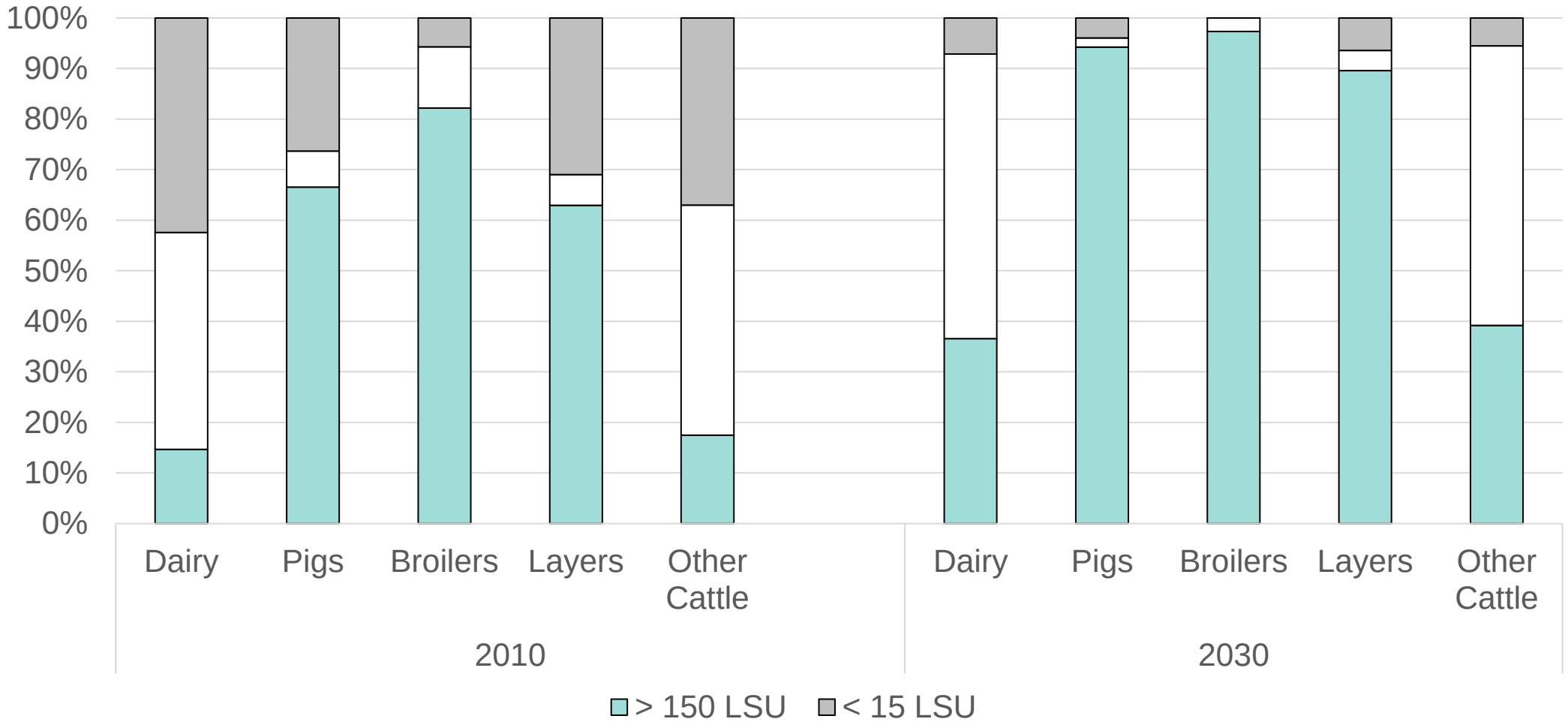
EU-27 Results – Compared to no control

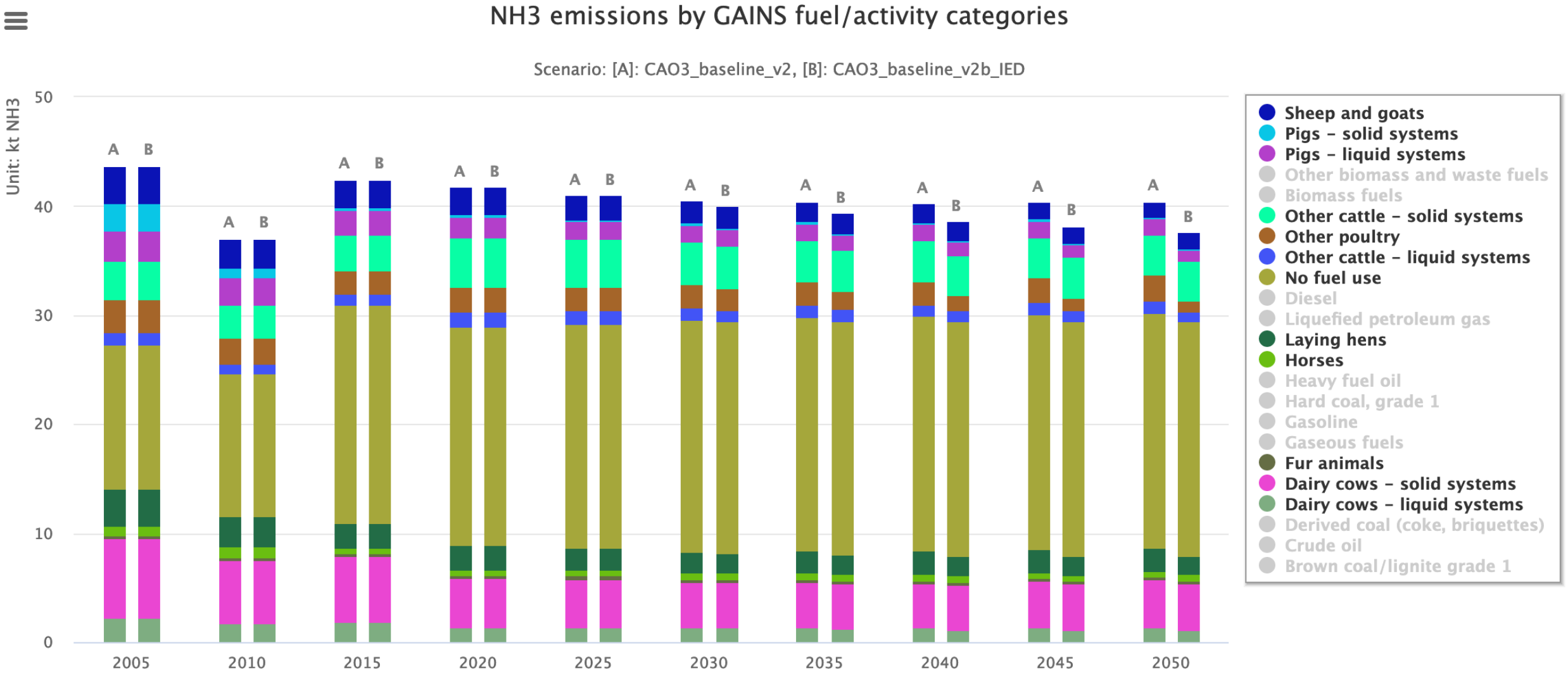



Dairy cattle
Other cattle
Pigs
Laying hens
Other poultry
2030
2050
0%
-10%
-20%
-30%
-40%
-50%
-60%
-70%
-80%
CLE 2030
CLE 2050
IED 2030
IED 2050
MFR 2030
MFR 2050

Extrapolation of structural changes

farm size distribution extrapolated for 2030 is used for the draft IED implementation



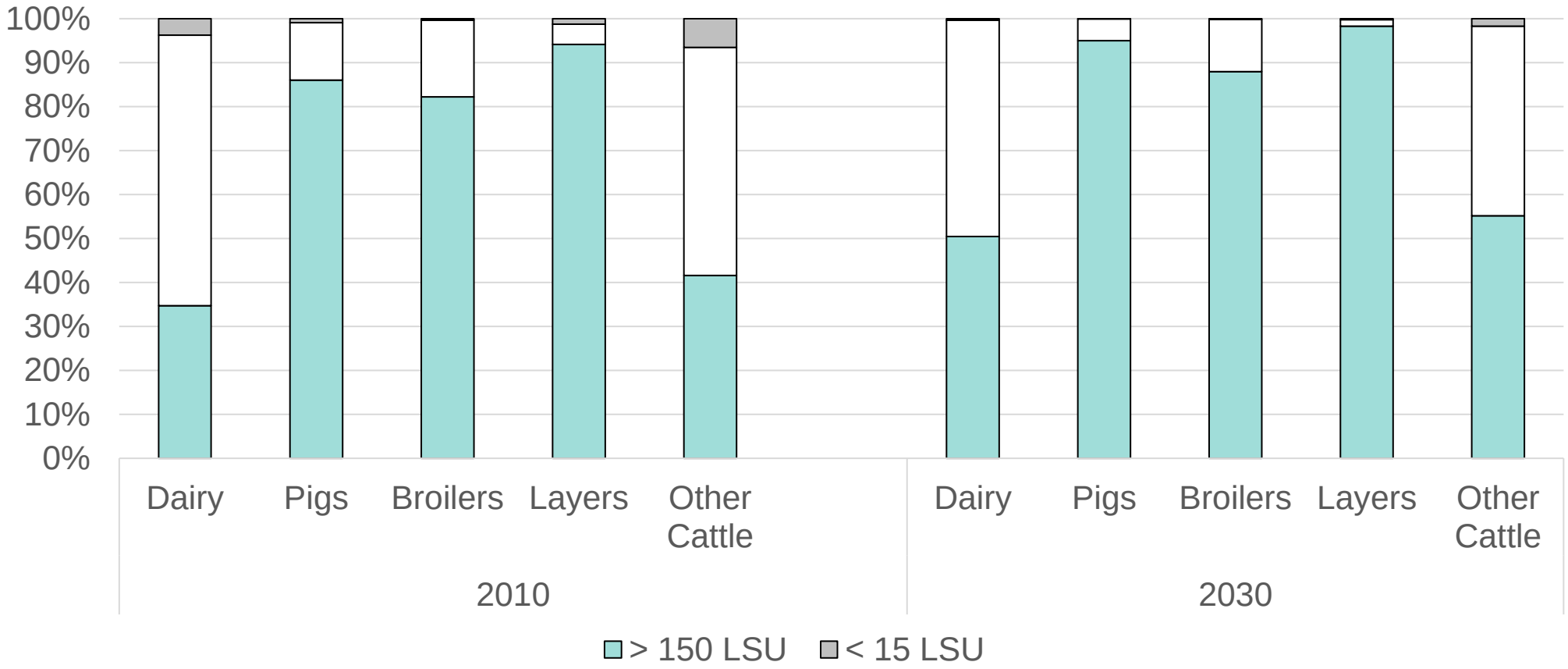


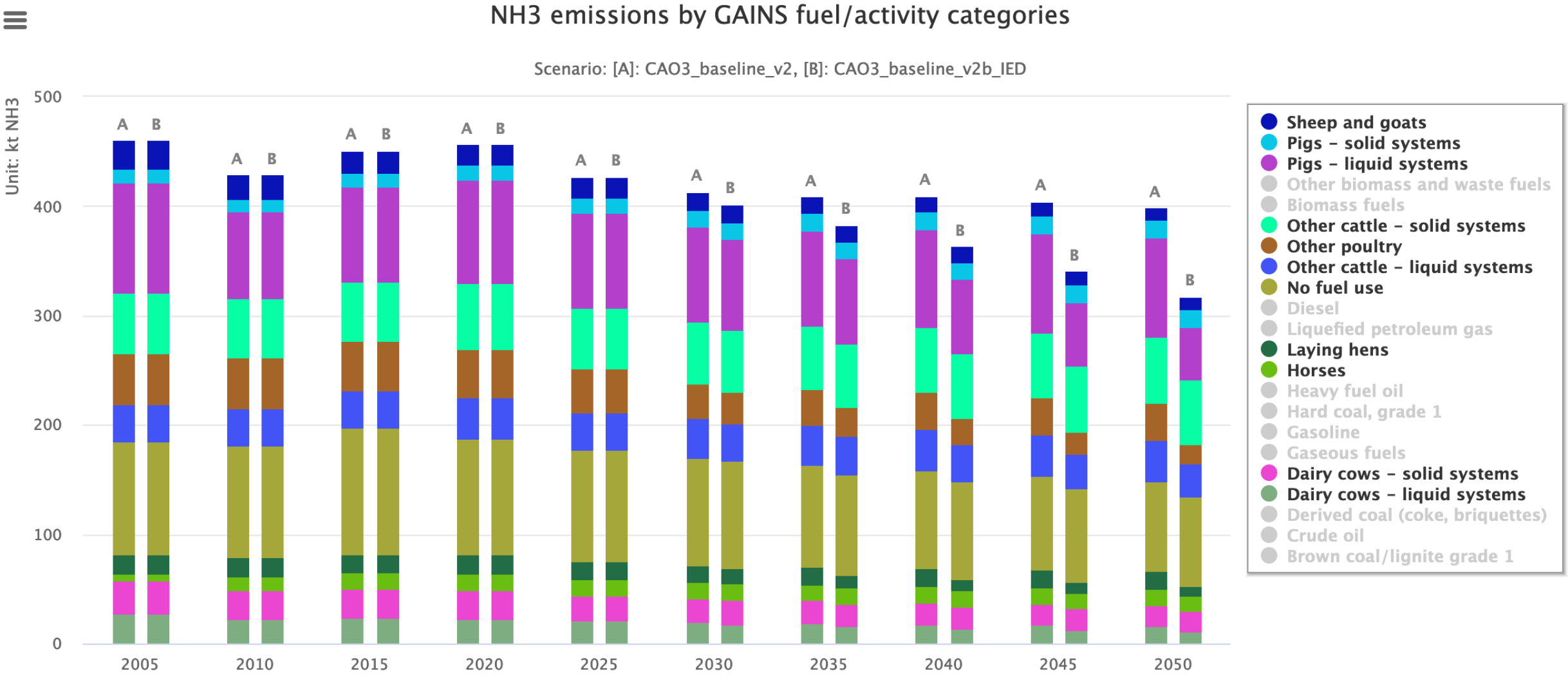
Total: -1%
Livestock: -3%

Total: -7%
Livestock: -15%

Extrapolation of structural changes

farm size distribution extrapolated for 2030 is used for the draft IED implementation



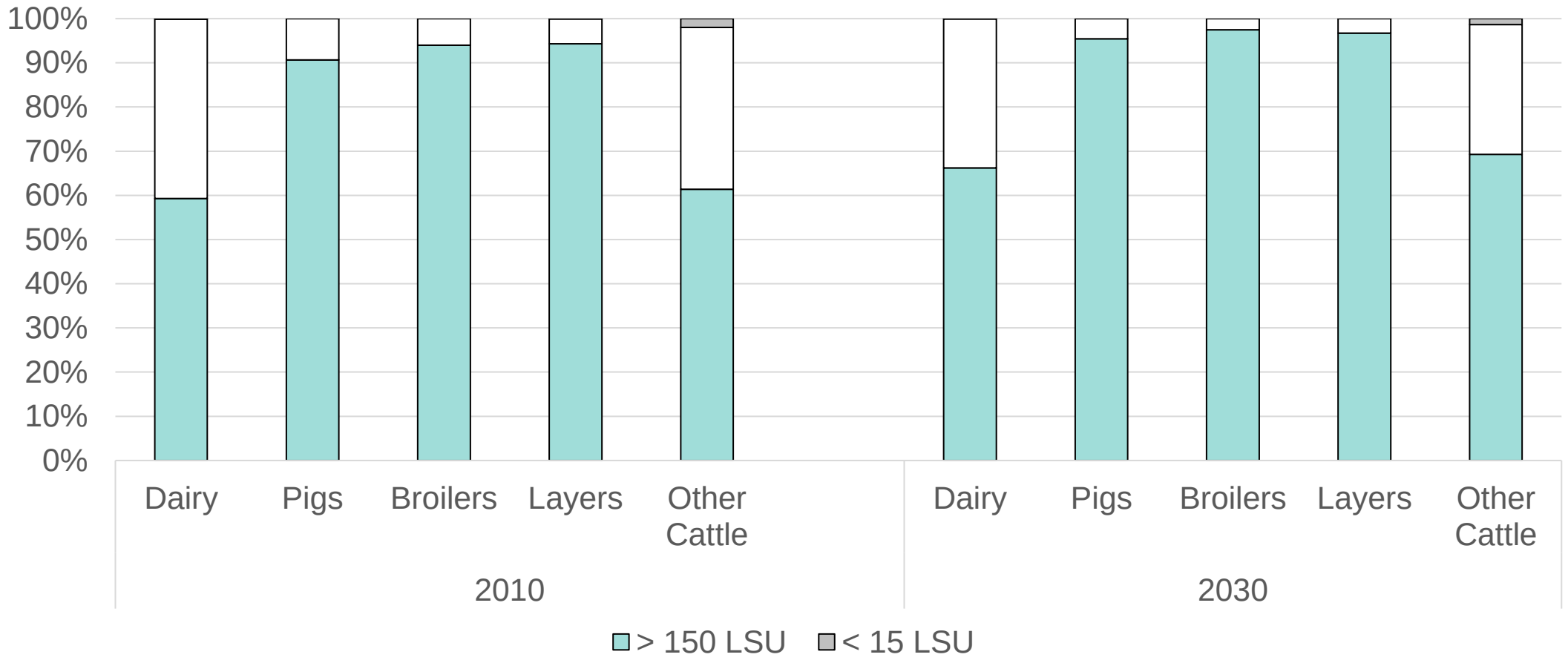


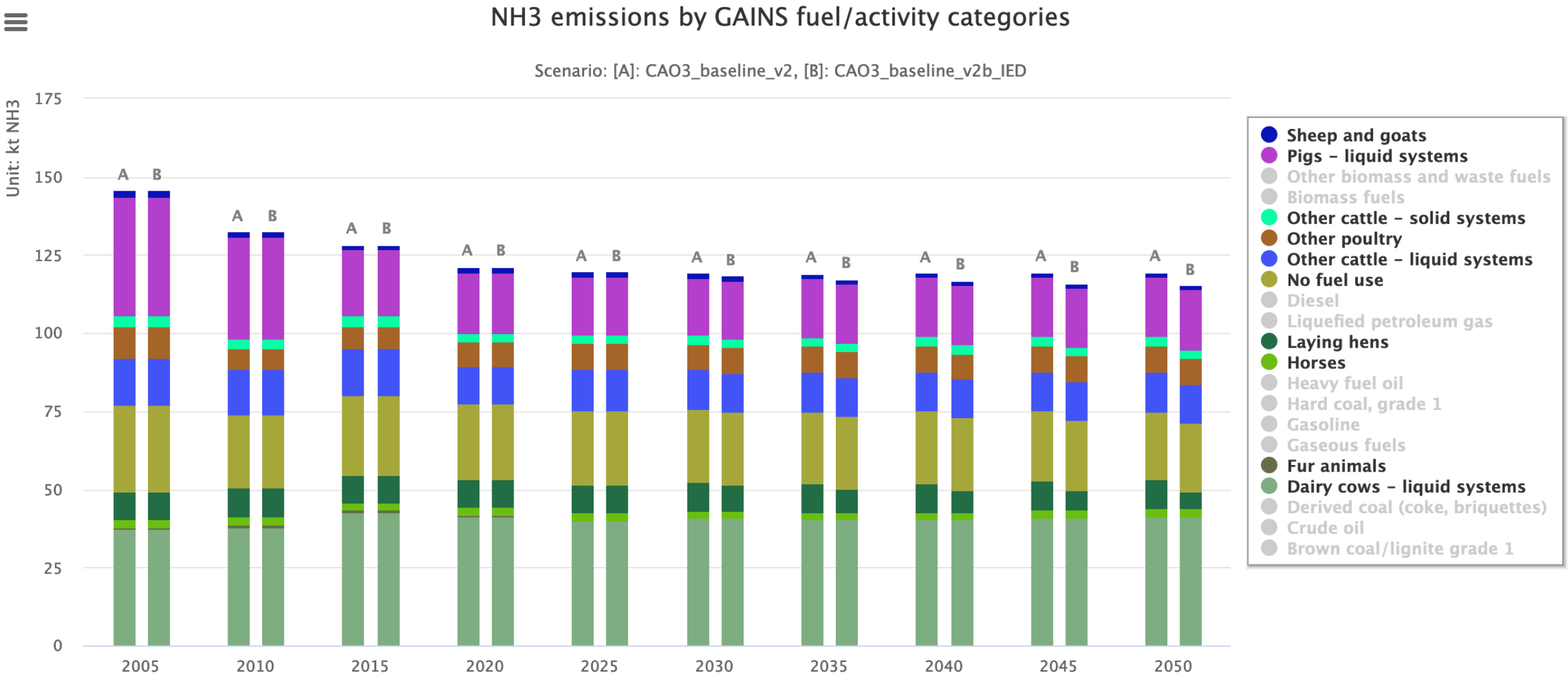
Total: -3%
Livestock: -4%

Total: -20%
Livestock: -26%

Extrapolation of structural changes

farm size distribution extrapolated for 2030 is used for the draft IED implementation





Total: -1%
Livestock: -3%

Total: -1%
Livestock: -4%

IED effect on total NH_3 emissions

- Reduction in total EU-27 NH_3 emissions in 2030: 3% (0-6%)
- Reduction in total EU-27 NH_3 emissions in 2050: 16% (7-20%)
- Country Differences based on:
  - Share of livestock emissions 10980
  - Implemented measures (CLE) – efficiency and extent
  - Farm structure (and development)
- Higher emission reduction is possible
- Reducing the threshold will lead to even lower reductions

References

Amann, M. et al. 2011. Cost-effective control of air quality and greenhouse gases in Europe: Modeling and policy applications. Environmental Modelling and Software, 26(12), 1489–1501.

EUROSTAT, 2023. https://ec.europa.eu/eurostat/databrowser/view/ef_lsk_main/default/table?lang=en

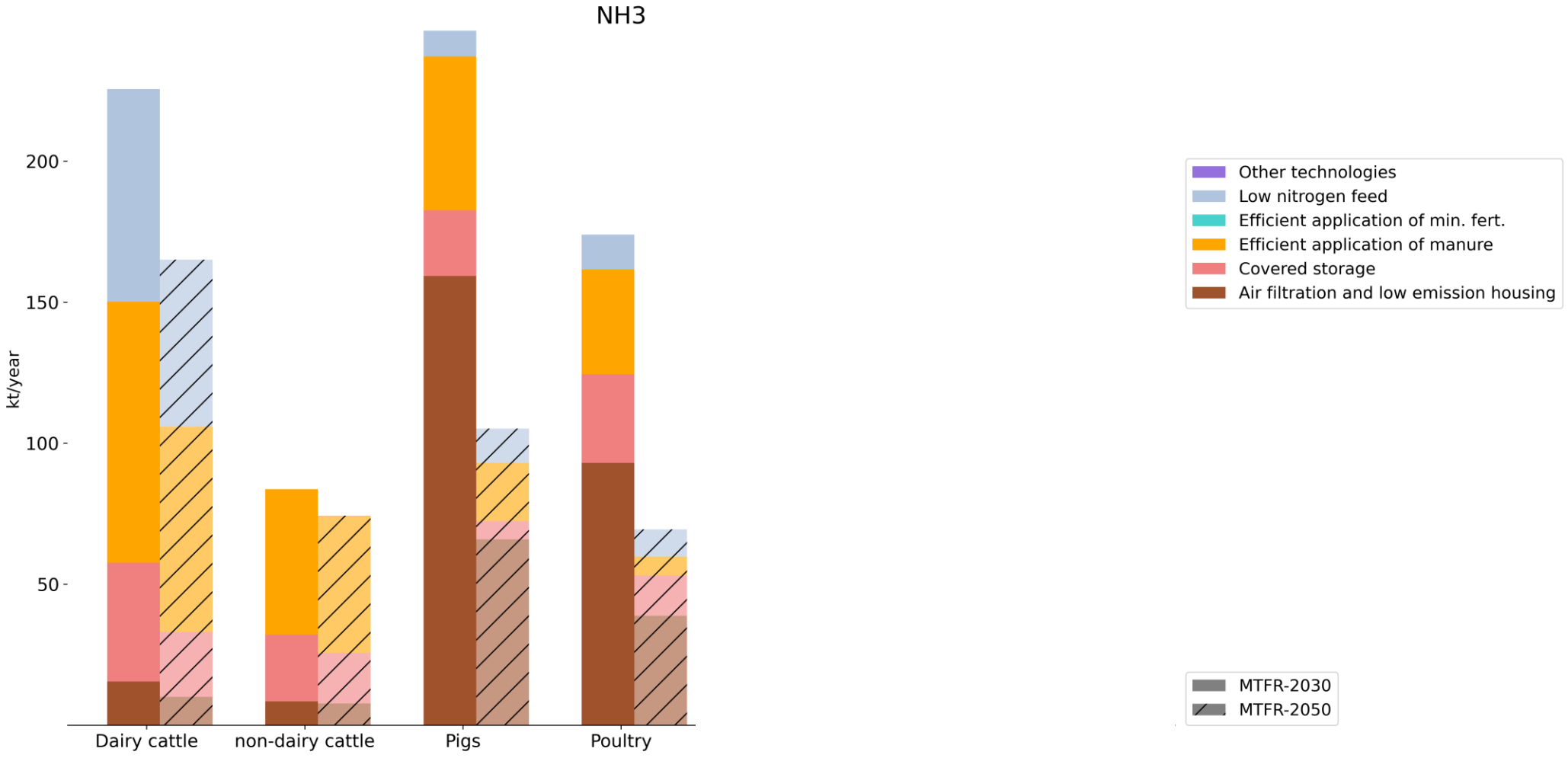
European Commission, 2022. https://environment.ec.europa.eu/publications/proposal-revision-industrial-emissions-directive_en

Klimont, Z. et al., 2022. Support to the development of the third Clean Air Outlook. https://circabc.europa.eu/ui/group/cd69a4b9-1a68-4d6c-9c48-77c0399f225d/library/bb998537-f96a-4ec5-b5ad-dd4e7fd144ed.

Leip, A. et al., 2015. Impacts of European livestock production: Nitrogen, sulphur, phosphorus and greenhouse gas emissions, land-use, water eutrophication and biodiversity. Environmental Research Letters, 10(11).

Wyer, K. E. et al., 2022. Ammonia emissions from agriculture and their contribution to fine particulate matter: A review of implications for human health. Journal of Environmental Management, 323(June 2021), 116285.

EU27


NH3
kt/year
200
150
100
50
Dairy cattle
non-dairy cattle
Pigs
Poultry
Other technologies
Low nitrogen feed
Efficient application of min. fert.
Efficient application of manure
Covered storage
Air filtration and low emission housing
MTFR-2030
MTFR-2050

NH_3 emission reduction options - selection

Abatememt Option		Removal efficiency (%)			
		Housing	Storage	Application	Total
Covered storage; mean efficiency	Dairy cattle	0%	72%	-6%	11%
	Pigs	0%	76%	-6%	13%
	Other poultry	0%	80%	-4%	6%
Low N application; mean efficiency	Dairy cattle	0%	0%	59%	30%
	Pigs	0%	0%	77%	26%
	Other poultry	0%	0%	80%	27%
Low N feed, covered storage, low N application	Dairy cattle	15%	76%	63%	51%
	Pigs	20%	81%	81%	53%
	Other poultry	10%	82%	81%	40%
Low N feed, housing adaptation, low N application	Dairy cattle	36%	82%	62%	58%
	Pigs	52%	83%	79%	68%
	Other poultry	86%	78%	77%	83%