How can agriculture contribute to EU climate targets?

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Alan Matthews
Professor Emeritus of European Agricultural Policy, Trinity College Dublin, Ireland
alan.matthews@tcd.ie

The context

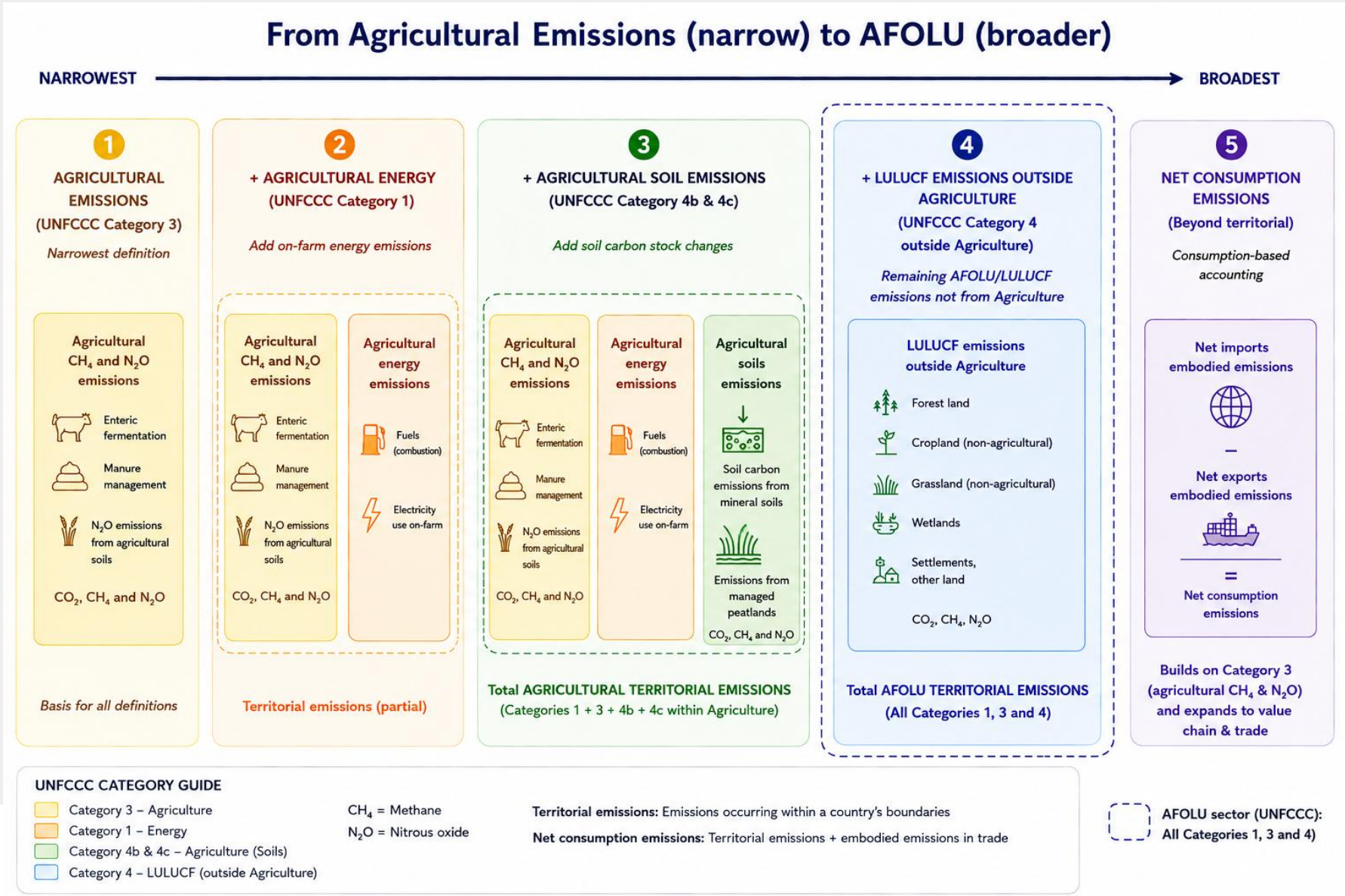
- The EU in March 2026 amended its Climate Law to introduce a legally binding 2040 target of a 90% reduction in net emissions, in addition to the net zero emissions commitment by 2050
  - International carbon credits can be used to fulfil up to 5 percentage points of this target
- While the Climate Law establishes the destination, sectoral legislation will determine the route
  - Commission work programme envisages ETS revision proposal in mid-2026, and ESR and LULUCF Regulation proposals in Q4 2026, possibly also affecting the CRCF Regulation
- The institutional architecture is up for redesign, what would be the most appropriate governance model for agricultural emissions in the post-2030 period?
- Recent report from the ESABCC *Climate adaptation and mitigation in the agri-food system* makes many recommendations, including to introduce a pricing model for agricultural emissions.

The roadmap

- Performance and projections
- Climate architecture and targets
- Mitigation toolbox and potential
- Incentivising climate action through the CAP
- Pricing agricultural emissions
- Longer-term issues

Performance and projections

Key definitions - different scopes for agricultural emissions



Author's illustration, developed with the assistance of OpenAI ChatGPT.

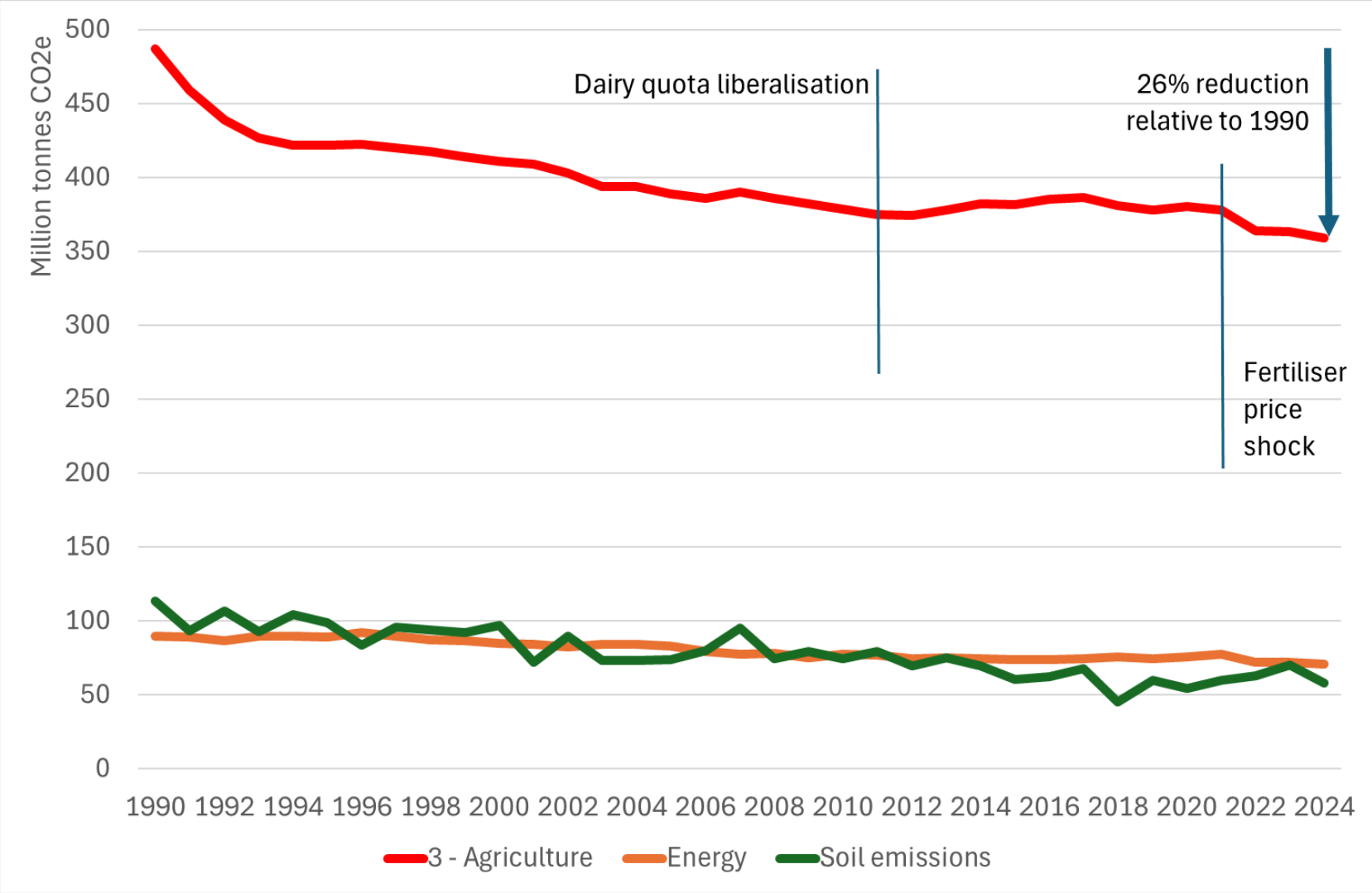
Relative magnitudes of different scopes (2024)

Million tonnes CO2e				
359	71	58	-289	+48
Total territorial agriculture		488		

The net consumption emissions are the additional emissions contributed by agricultural imports less agricultural exports in this table (exc. LULUCF)

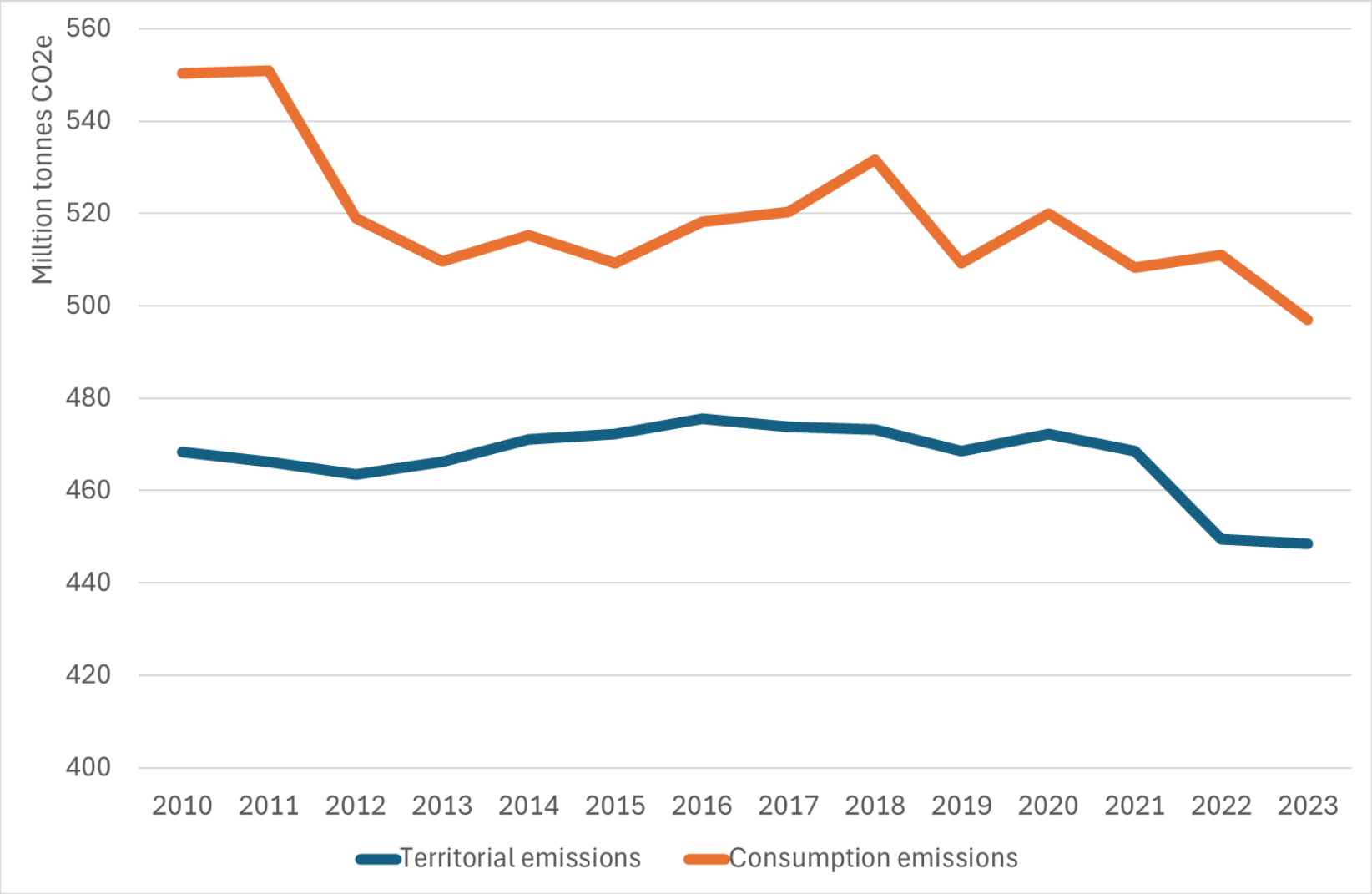
Source: EAA, GHG data viewer; Eurostat, Greenhouse gas emission footprints (in CO2 equivalent, FIGARO application) (env_ac_ghgfp)

EU agricultural GHG emissions 1990-2024



Source: EAA, GHG data viewer

Agricultural consumption-based emissions have fallen (broadly) in line with territorial emissions

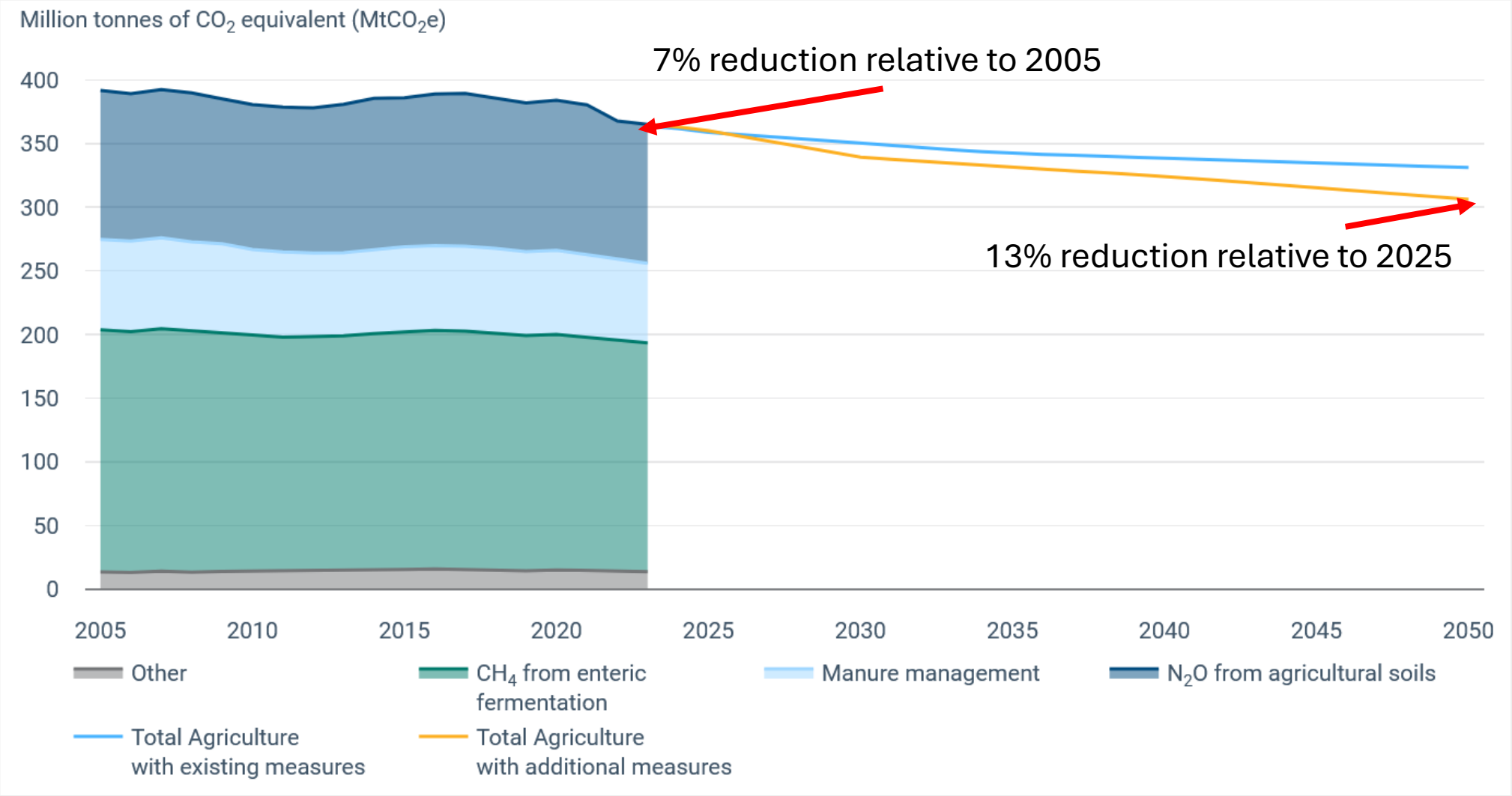


Emissions from NACE A01 Crop and animal production, hunting and related service activities

Consumption emissions exclude land use change

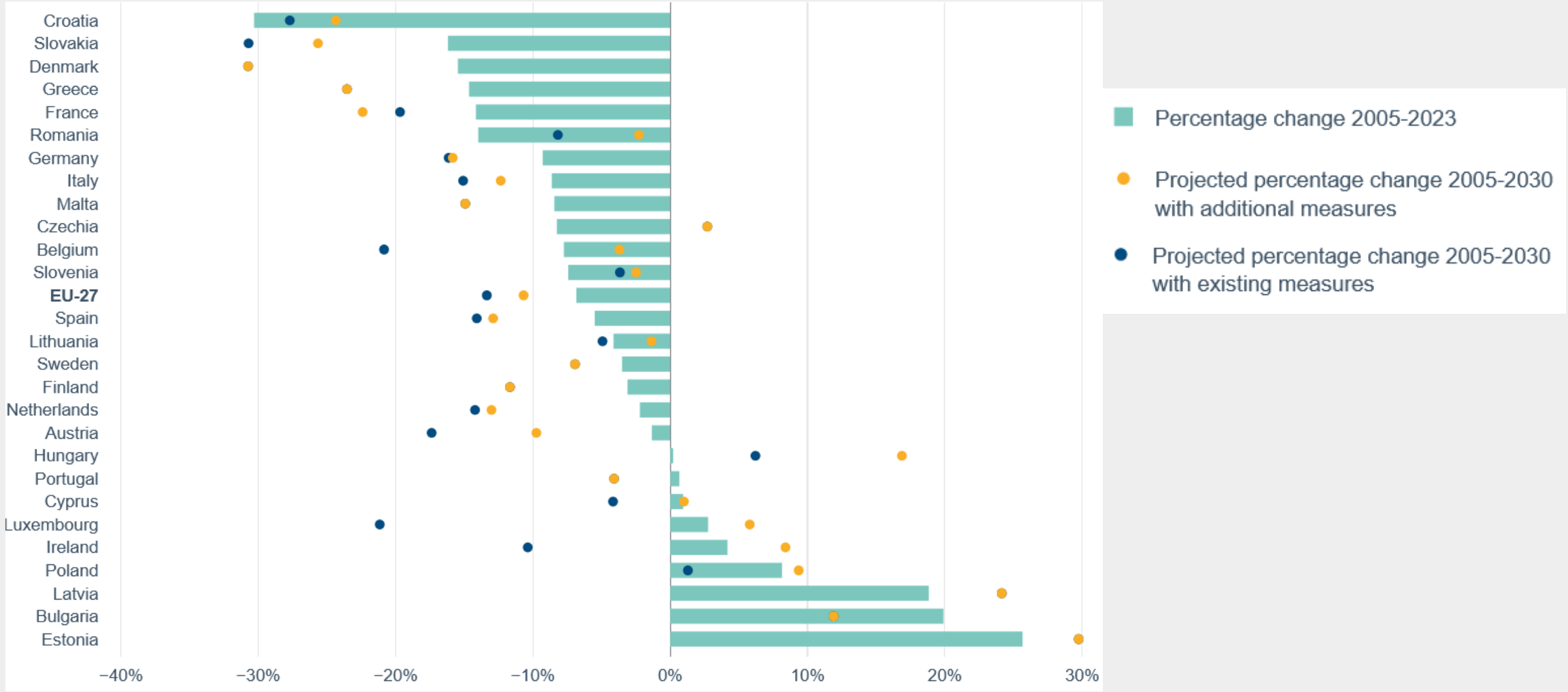
Source: Eurostat, Greenhouse gas emission footprints (in CO2 equivalent, FIGARO application) (env_ac_ghgfp)

EU agricultural non-CO_2 emissions by source and projected emissions



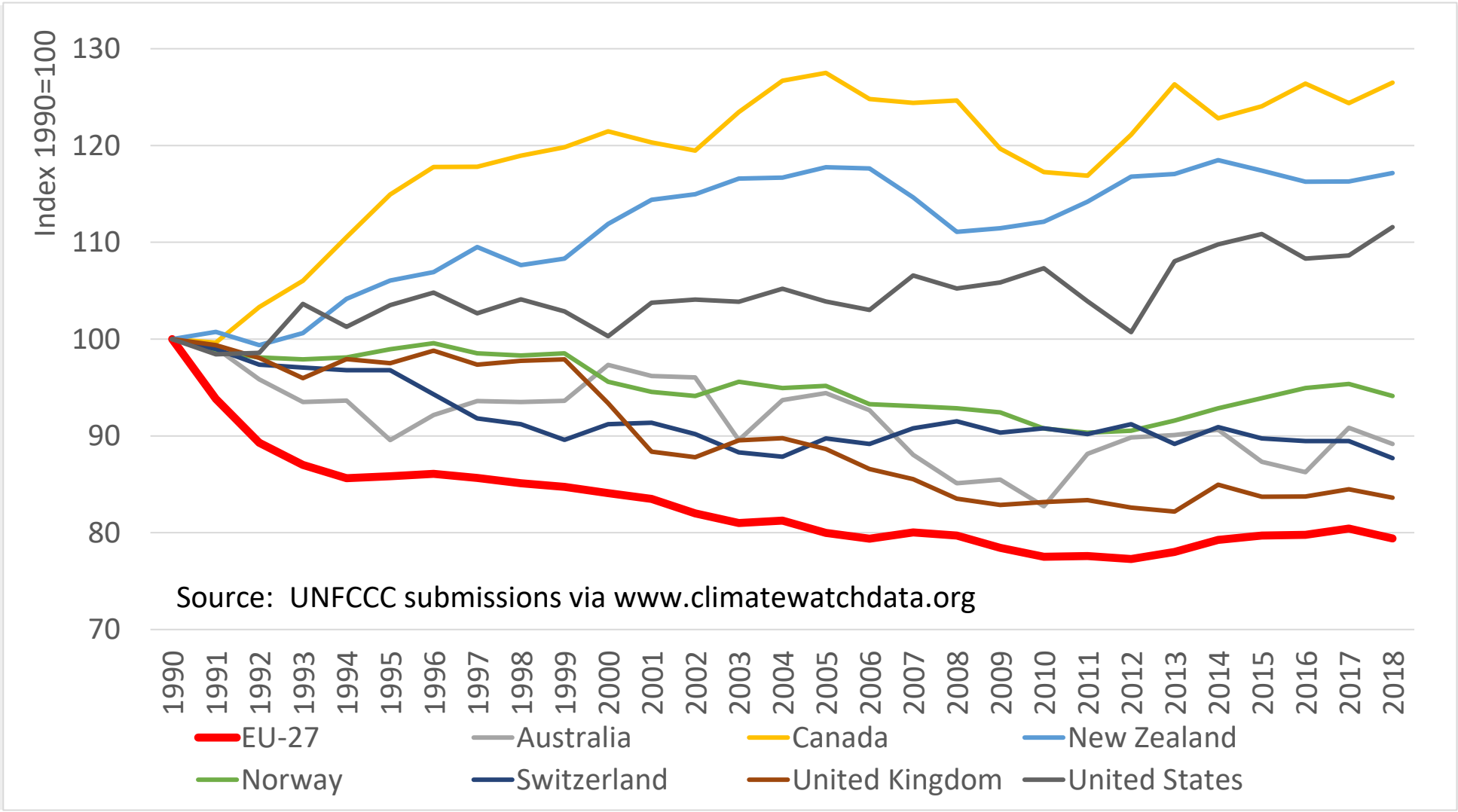
Source: EEA, Greenhouse gas emissions from agriculture in Europe, Nov 2025

Change in agricultural emissions and projected emissions by EU Member State, 2005 - 2023

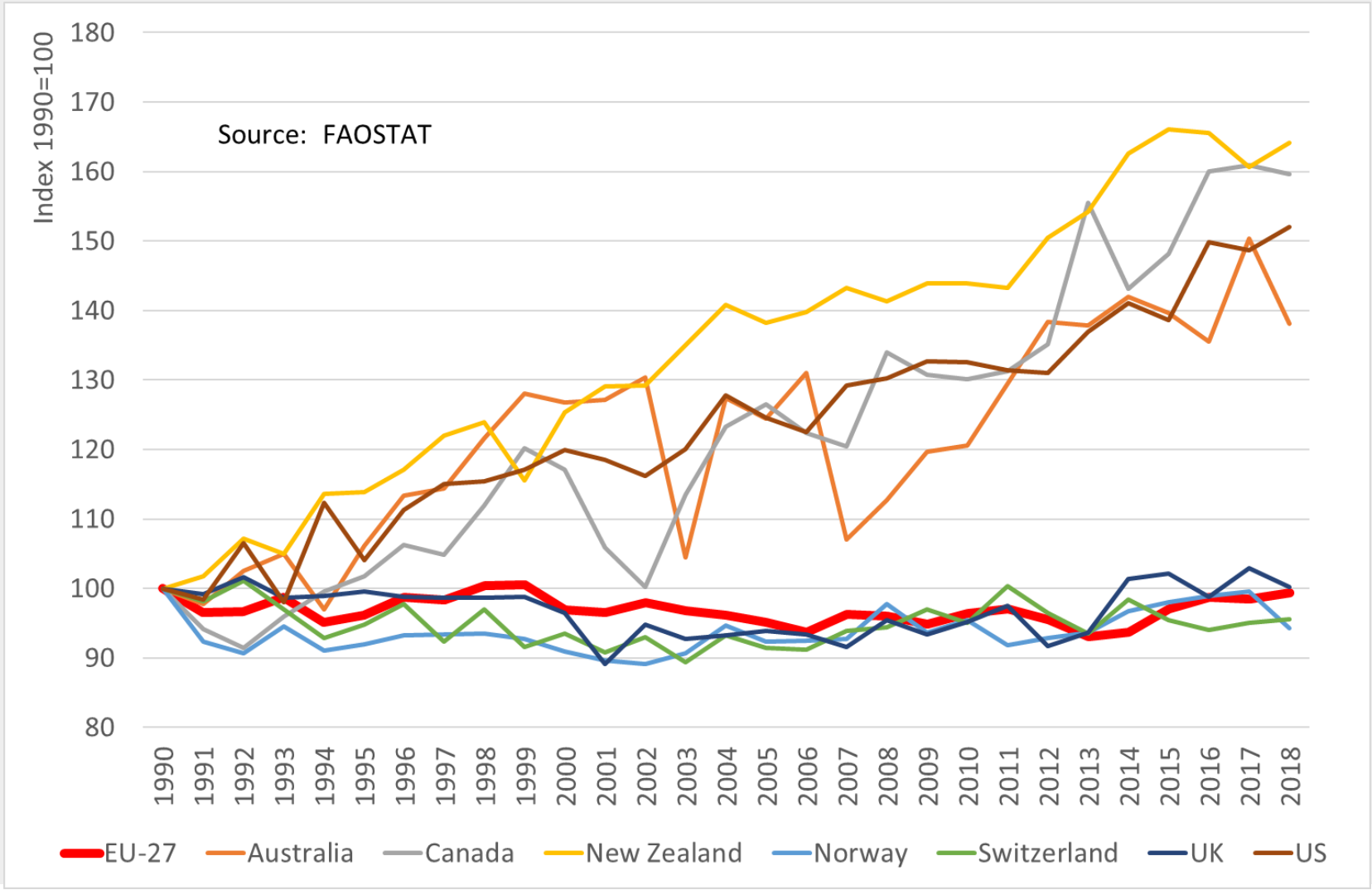


Source: EEA, Greenhouse gas emissions from agriculture in Europe, Nov 2025

Comparison of trends in agricultural emissions, 1990-2018



Agricultural production index, 1990=100

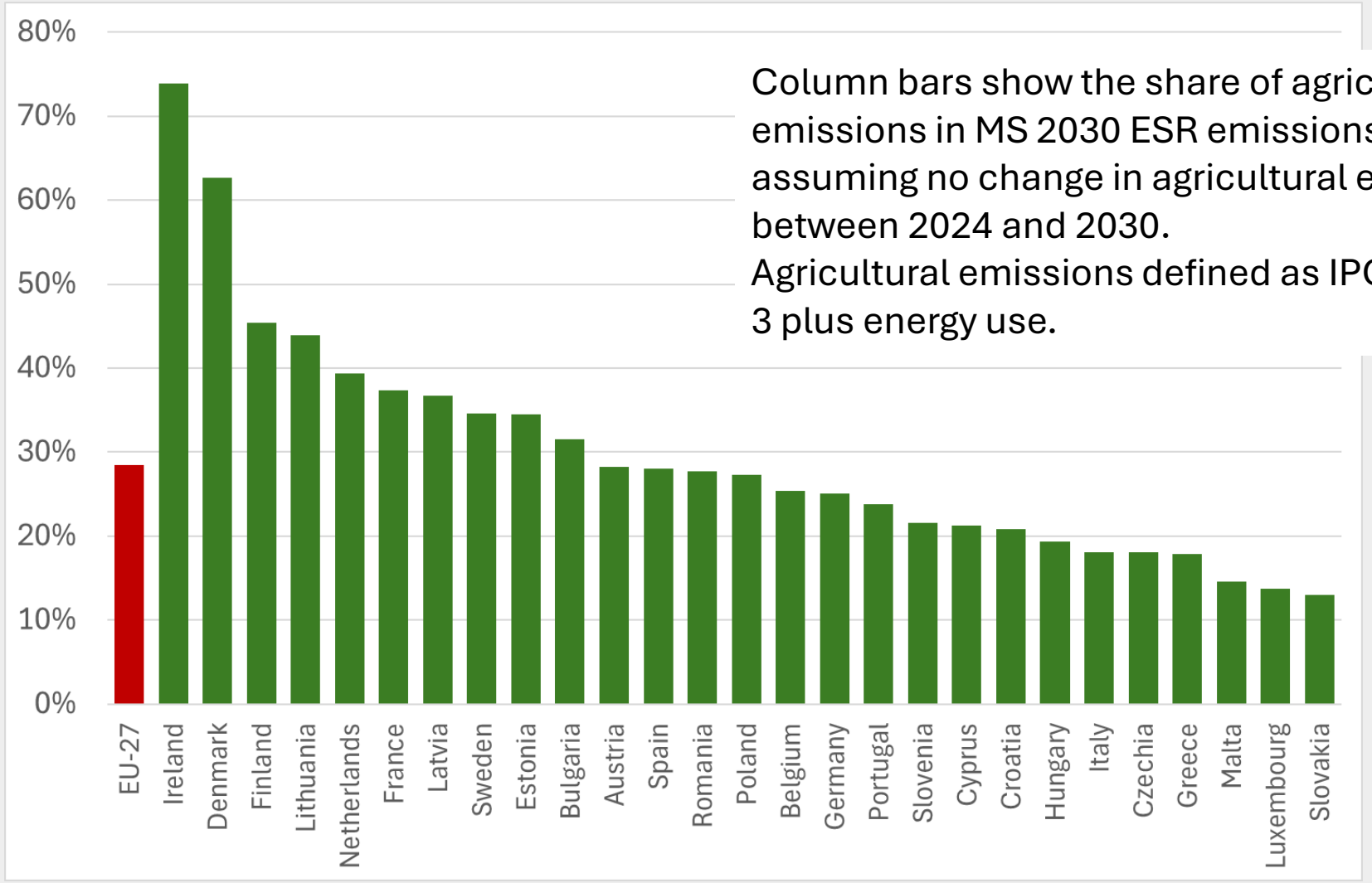


Climate architecture and targets

The EU agricultural climate architecture

- ETS2 Regulation (covers emissions from fuels used for heat in buildings, road transport and small industrial emitters, operational from 2028)
  - Agricultural fossil energy use not covered, but MSs can use opt-in option to unilaterally extend coverage
  - To date, only Finland appears to have extended to agricultural energy use, Netherlands and Sweden include agricultural machinery and vehicles
  - Allowance price initially capped at €45/t CO_2
- ESR Regulation (covers agricultural energy plus non-CO_2 emissions)
  - Agriculture share of ESR ceiling varies significantly across MSs (next slide)
  - No specific obligation to address agricultural emissions
- LULUCF Regulation (covers soil emissions)
- No automatic sanctions for non-compliance

Importance of agricultural emissions in MS ESR ceilings



Column bars show the share of agricultural emissions in MS 2030 ESR emissions ceiling, assuming no change in agricultural emissions between 2024 and 2030.
Agricultural emissions defined as IPCC Category 3 plus energy use.

Source: Own calculations using 2024 emissions data from EEA, GHG data viewer, 2005 emissions from Implementing Regulation 2020/2126 amended Annex 1 and reduction commitments from EU Regulation 2018/842 amended Annex 1

Member States national targets for agricultural emissions

Country	Target	Date
Denmark	55-65% reduction in GHG emissions from agriculture and forestry by 2030 compared to 1990 levels	2021
France	72 Mt CO2eq carbon budget for agriculture and forestry (excl. LULUCF) in 2029-2033	2020
Germany	56 Mt CO2eq permissible annual emission budget for agriculture in 2030	2019
Ireland	25% emission reduction for agriculture by 2030 compared to 2018 levels	2022
Lithuania	11% GHG emissions reductions in agriculture by 2030, compared to 2005	2021
Netherlands	3.5 Mt GHG emissions reduction in agriculture and land use sectors by 2030	2019
Portugal	11% reductions of CO2eq emissions from agriculture by 2030 compared to 2005	2019
Slovenia	22% emissions reduction by 2050 in agriculture, compared to 2005, with intermediate targets of 1% reduction by 2030 and 8% by 2040	2021

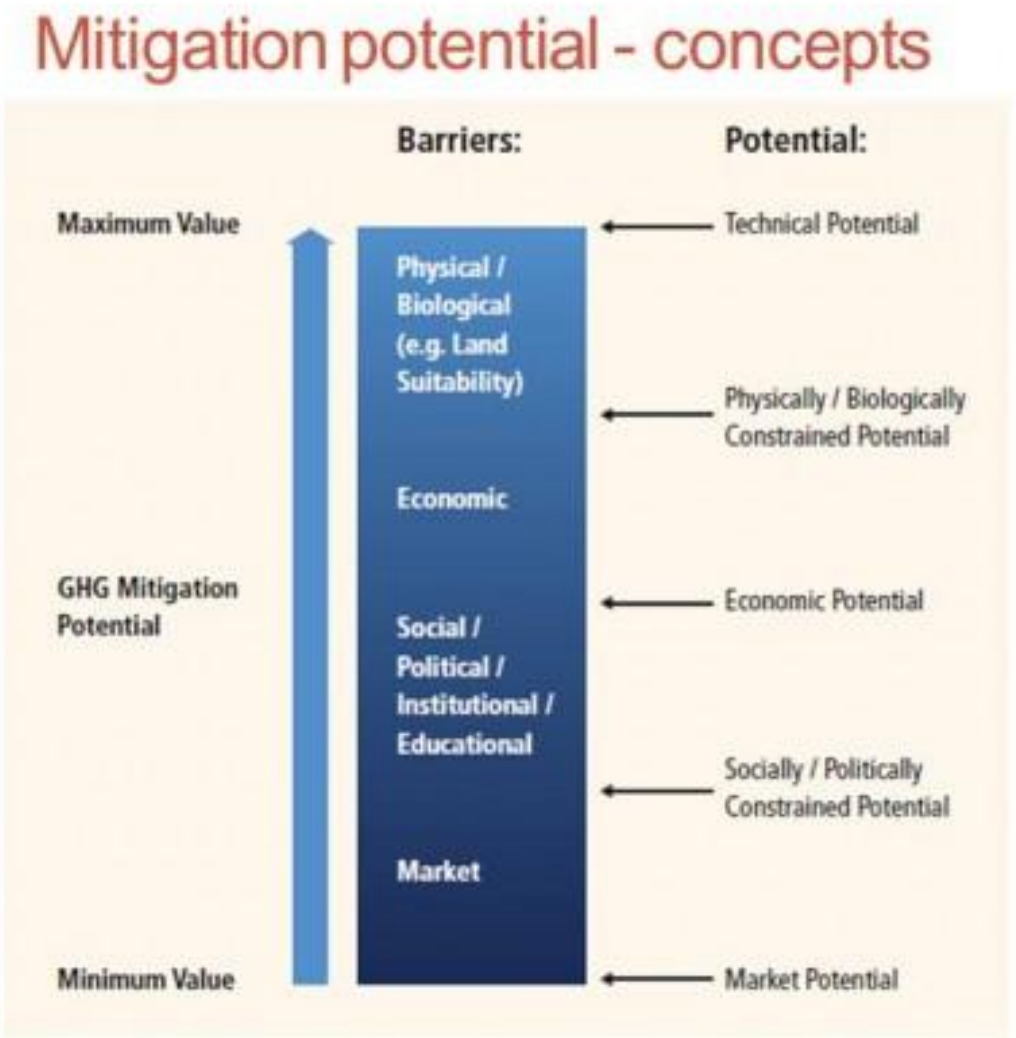
Source: de Hoof, 2023. Revised and additional commitments may have been made

Mitigation toolbox and potential

Decarbonisation pathways in agriculture

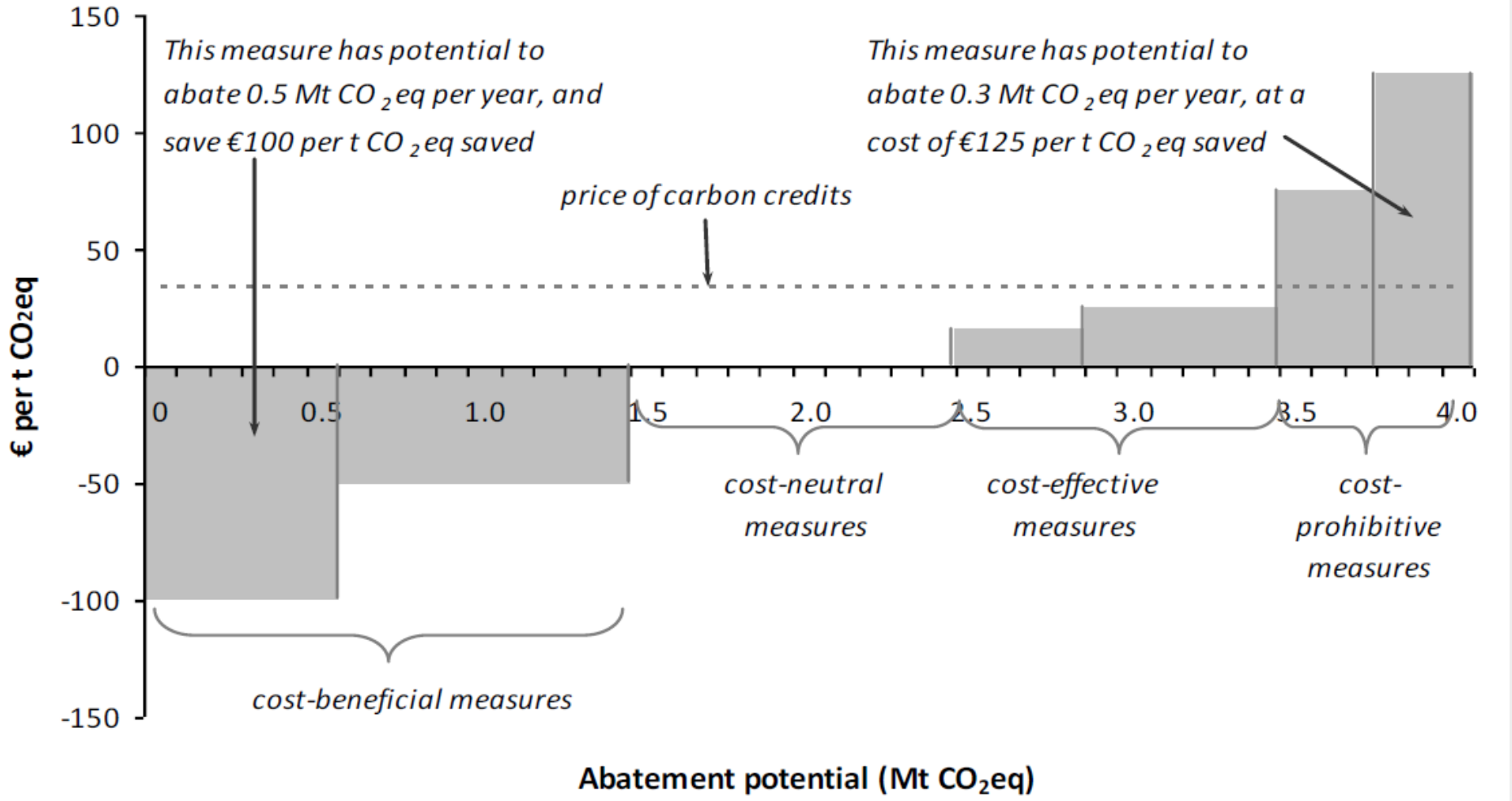
- **Improve emissions efficiency** through technological innovation and better management (e.g., methane inhibitors, precision nutrient management, genetics, energy efficiency)
- **Change the production mix** towards lower-emission enterprises and products as relative prices and consumer demand evolve.
- **Transition land use** towards lower-emission uses, including forestry, peatland restoration, perennial biomass, renewable energy and other bioeconomy activities.
- **Reduce fossil fuel dependence** through electrification, renewable energy and lower-carbon energy sources for agricultural operations.
- **Demand-side drivers** include dietary shifts and food waste reduction, including promotion of alternative proteins
- **Increase carbon removals** by enhancing soil carbon and biomass sequestration – does not reduce emissions but can compensate for residual emissions.

Concepts of mitigation potential



Source: Smith et al. IPCC WG3 report, Chap 11 AFOLU, 2014

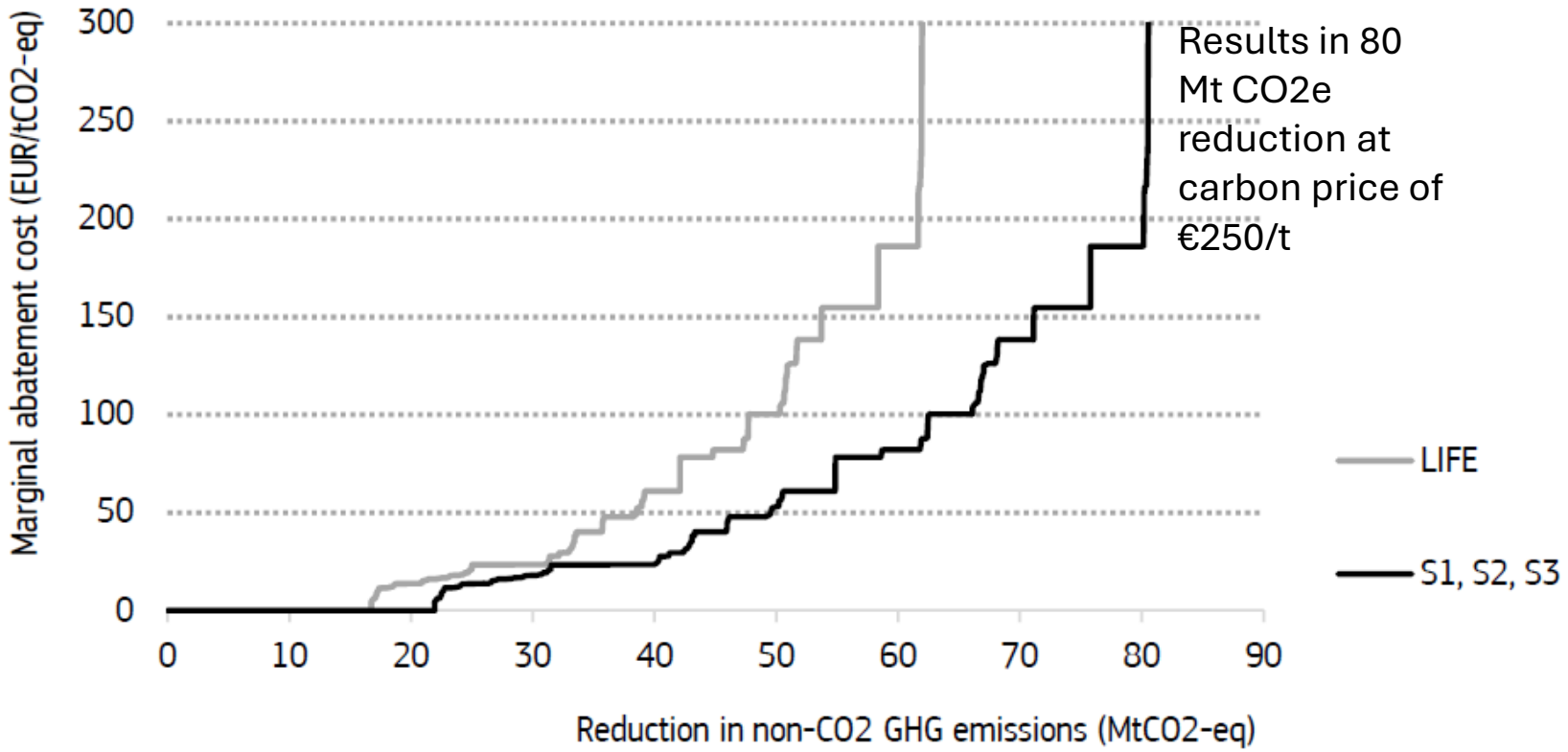
Marginal abatement cost curve – a useful tool to assess technical mitigation potential



Source: Lanigan et al, Teagasc, Ireland, 2023

Mitigation potential at different costs for EU

Figure 81: MACC of the agriculture sector in 2040 per scenario

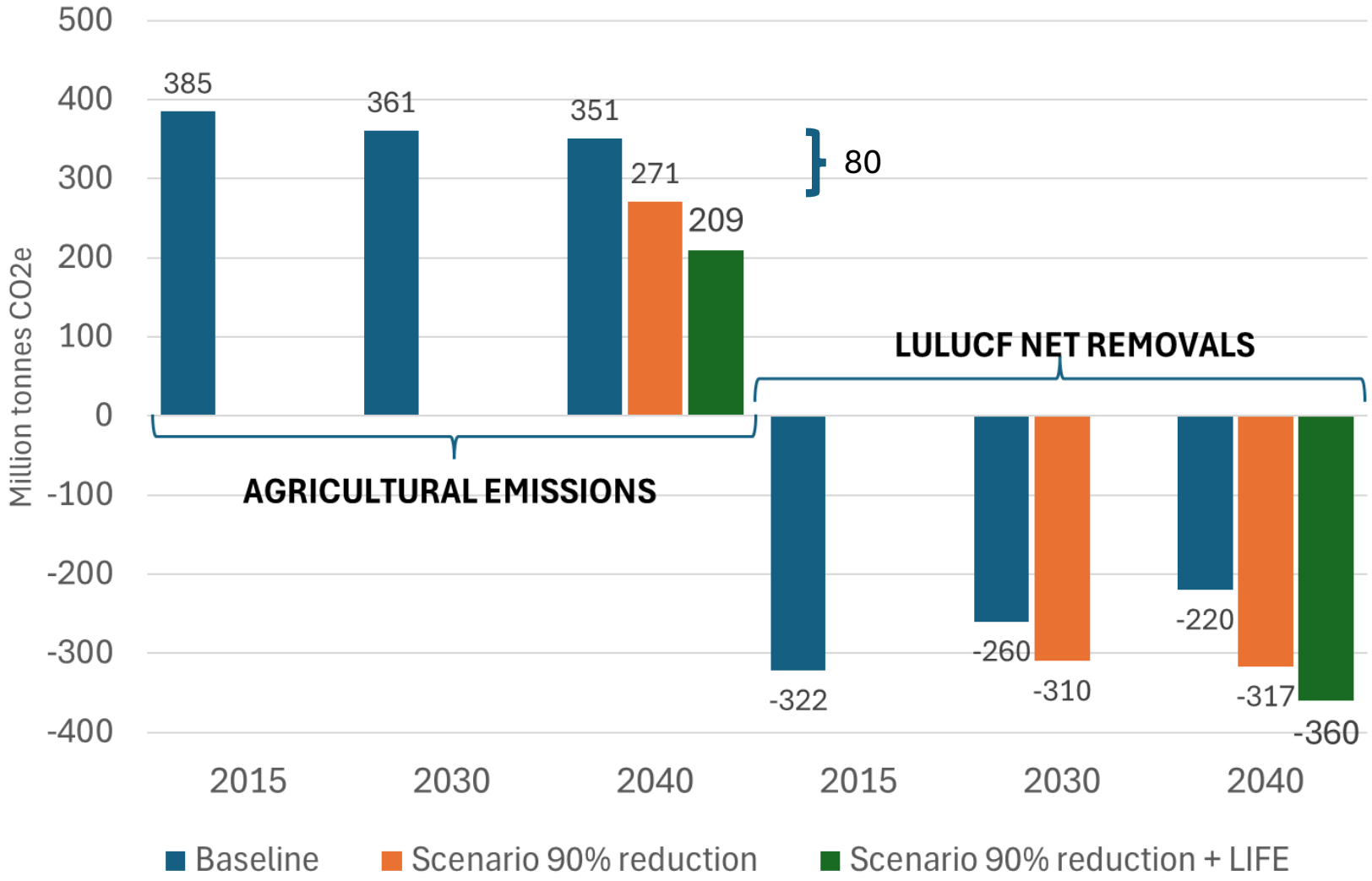


Note: Marginal abatement costs are expressed in constant EUR 2015.

Source: GAINS.

Source: Commission, Impact Assessment Report accompanying Communication on EU 2040 climate target SWD(2024) 63, Annex 8, Section 1.7.4, p. 369. The LIFE scenario has lower mitigation potential because of lower emissions already in the baseline scenario.

Potential pathways for the land sector towards 2040



Source: Commission, Communication 2040 target Impact Assessment. LULUCF baseline removals in 2030 is EEA WAM projection

These mitigation potentials are achieved in the GAINS model by applying a carbon value of €290 in 2023 prices in 2040 (€250 in the LIFE scenario)

LIFE scenario assumes 25% shift towards EAT-Lancet diet by 2040, achievement of F2F targets and food waste reduction.

Residual agricultural emissions in 2050

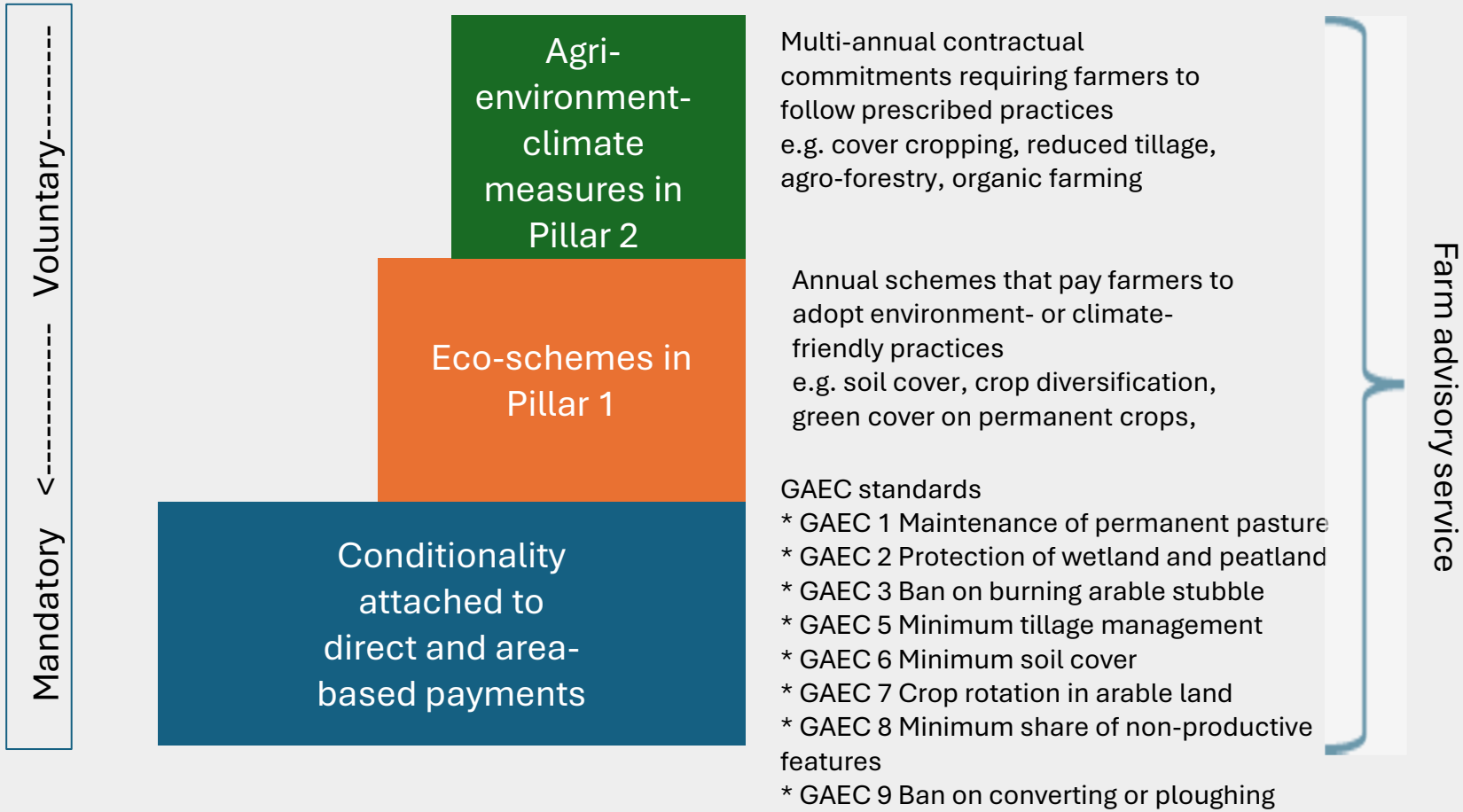
Study	Scenario	End date	Remaining emissions from agriculture (Mt CO2e)	GHG reduction compared to 2023 emissions
Agora Agriculture (2024)	Agora Agriculture	2045/2050	150	59%
Commission, 2040 target IA (2024)	LIFE	2050	194	47%
TYFA (Aubert et al., 2019)	TYFA-GHG	2050	203	44%
TYFA (Poux & Aubert, 2018)	TYFA main	2050	243	33%
Commission, 2040 IA (2024)	S2, S3	2050	249	32%
EcAMPA IV (Pérez Domínguez et al., 2025)	CP scenario	2050	275	25%

Source: Springer, K. *Residual emissions in EU agriculture: Analysis of emission reduction scenarios, Institute for European Environmental Policy.*

Incentivising climate action through the CAP

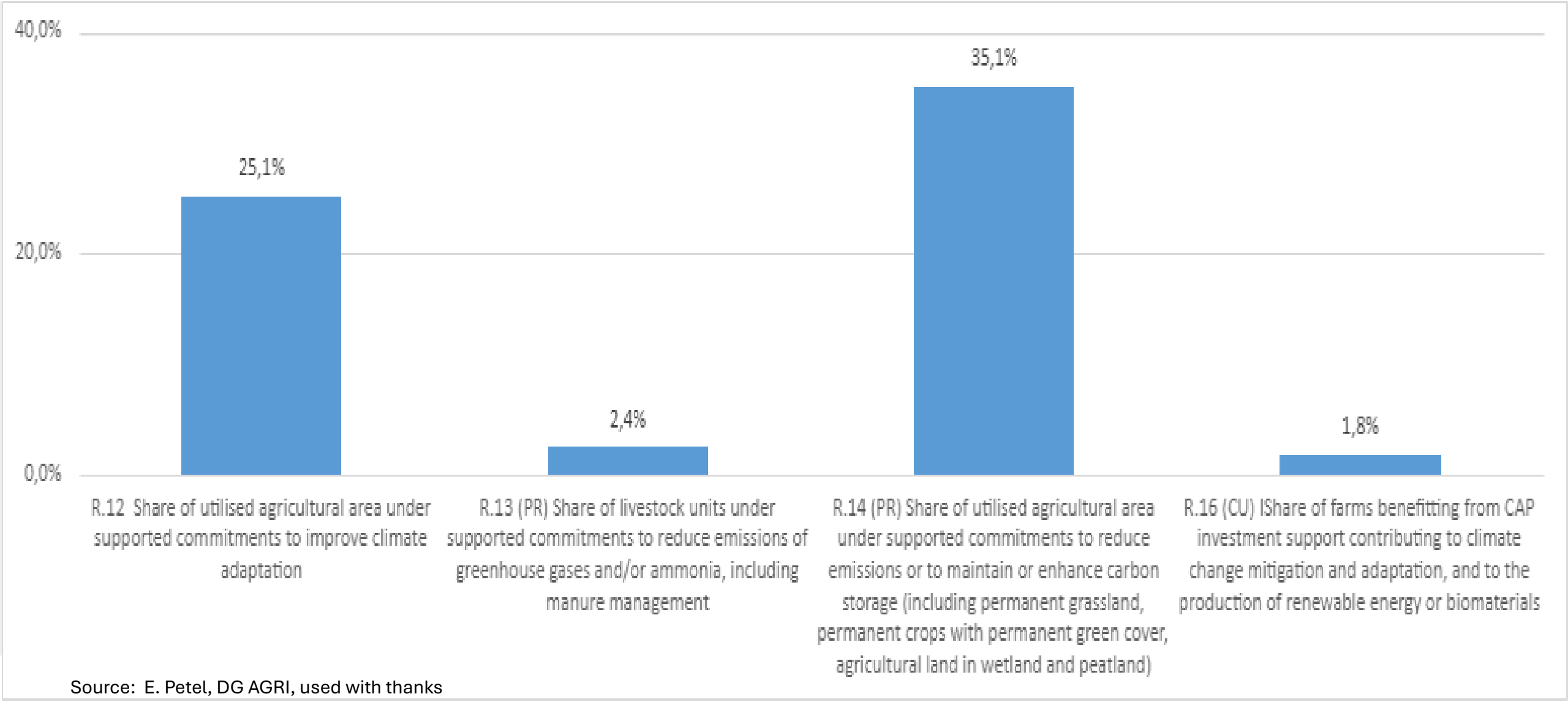
CAP support for climate mitigation

Green architecture



Climate mainstreaming/tracking to ensure at least 40% of CAP expenditure contributes to climate objectives

Key targets - climate adaptation and mitigation (beyond conditionality), EU-27



Source: E. Petel, DG AGRI, used with thanks

Limited contribution of CAP to climate mitigation to date

CAP 2014-2022

- Specialist grazing livestock farms depend heavily on direct payments for their income
- Coupled payments largely support ruminant livestock
- Very few measures directed to reducing methane and nitrous oxide emissions
- Voluntary payments support practices that can sequester soil carbon but are not result-based and were often not additional
- Direct payments encourage continued production on organic (peatland) soils, but if restoration (rewetting) occurs, area may no longer be eligible for payments
- Emission reductions quantified as 6 Mt CO2e and carbon removals at 20.2 Mt CO2e (Alliance Environnment 2019)

CAP Strategic Plans 2023-2027 mitigation potential

- Estimates a projected 31 Mt CO2e reduction (relative to 400 Mt CO2e emissions from agriculture and related land use) mostly in form of increased carbon sequestration due to crop rotation, cover crops and organic farming (DG AGRI/EU CAP Network 2024)

Pricing agricultural emissions

The rationale for pricing

- Polluter Pays Principle currently not applied to agricultural emissions (ECA 2021)
- Subsidies alone have limitations: lack of measurable targets, dilution through multiple objectives, deadweight losses, behavioural barriers, and rebound effects
- Pricing creates continuous financial incentives integrated into farm decision-making, transforming emissions from externality to operational expense
- Pricing achieves aggregate emission reductions at the lowest societal expense by allowing farmers to innovate or adapt based on their specific circumstances
- Provides a business case for innovation into mitigation technologies
- Carbon pricing has worked in the energy and industrial sectors

How to price?

- Carbon levy/rebate vs agricultural emissions trading scheme (AgETS) with credits
- Carbon levy/rebate much simpler to administer (farmer receives a tax statement once a year based on inputted data) and provides farmers with stable long-term signal for investment (preferred in DK and NZ)
- Usually ruled out at EU level due to unanimity required for tax measures
- Hence EU focus has been on AgETS design
  - Three models: voluntary public procurement of carbon credits, mandatory climate Scope 3 targets for processors or retailers, on-farm AgETS trading scheme
  - Trinomics (2023), Trinomics (2025), ESABCC (2026)

AgETS core design principles

- **CAP:** Declining emissions limit aligned with 2040/2050 climate targets, but would not reduce to zero
- **Linear reduction factor**: annual reduction in allowances
- **Scope**: enteric fermentation, manure management, agricultural soils?
- **Point of obligation**: farm-level provides direct incentives, processor-level is administratively simpler. A processor levy is a tax on production rather than emissions unless farm-level accounts are integrated into reporting
  - Stronger argument to address N_2O emissions and fertiliser use at point of sale
- **Incidence of pricing:** point of obligation does not affect the economic incidence of who ultimately pays for allowances
  - Government might pay for MRV costs

Can we do MRV and at reasonable cost at farm level?

- Considerable effort going into result-based MRV options for carbon farming credits in several Horizon Europe projects
- Nonetheless, suggest to base MRV on activity levels and emission factors rather than direct measurement, at least initially
  - But recall that national inventory calculation methods are not yet standardised
- Make two-way connection with national inventories, increasing granularity of recognised mitigation options over time
- Much relevant data collected for administrative purposes already, which would allow a compliance registry to determine allowance obligation
- Brokerage and transaction fees could be significant in an AgETS, as would the need for robust back-end infrastructure to manage allowance holdings, handle transactions and enforce compliance

Other design issues

- **Managing price volatility:** varying allowance prices over time introduces another source of risk for farmers that must be managed
  - Financial hedging strategies would be prohibitive for individual farmers
  - Possible answers include a market stability reserve, fixed-price allowance sales, price collars
- **Integration with carbon removals:** allows farmers more flexibility to manage their emissions profile
  - Must address risks of mitigation deterrence, equivalence of temporary removals with sustained emissions, addressing reversals
- **De minimis thresholds:** can reduce administrative costs but with some loss of efficiency and risk of market disruption
- **Treatment of methane**: how characteristics of methane as a flow pollutant should be reflected in the design of a pricing scheme.

Addressing other concerns

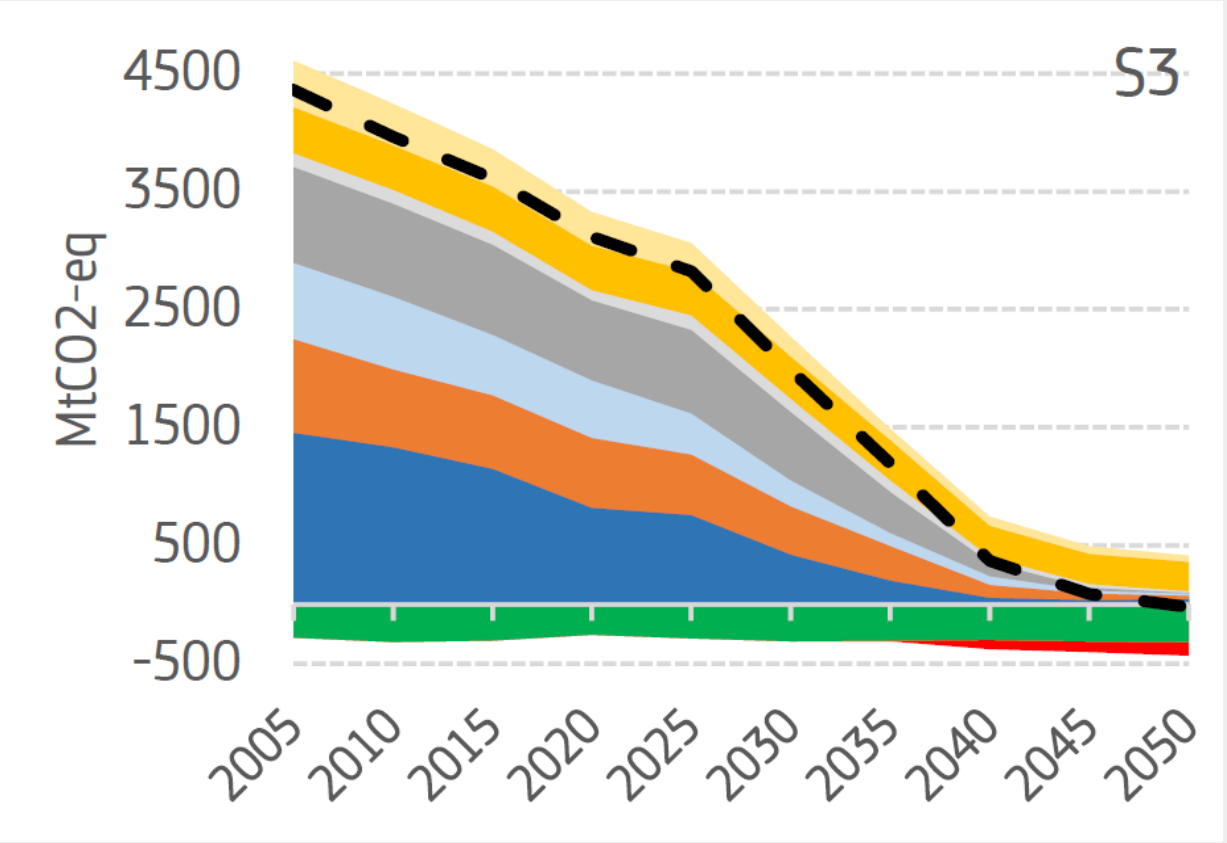
- **Excessive adjustment costs** if farmers unable to pass on emissions price
  - Address through free allowances based on benchmark allocation
    - Danish example provides for 60% rebate, original NZ ETS proposal was 95%, though reducing over time
    - A system of free allowances based on production inhibits production adjustment, and will require significantly higher allowance prices to achieve the same emissions reduction
  - Provide subsidies to offset cost of mitigation technologies
- **Recycle auction revenue** back to farmers
  - Model of Social Climate Fund in ETS2, but also implies extra complexity as it gives rise to intra-MS transfers

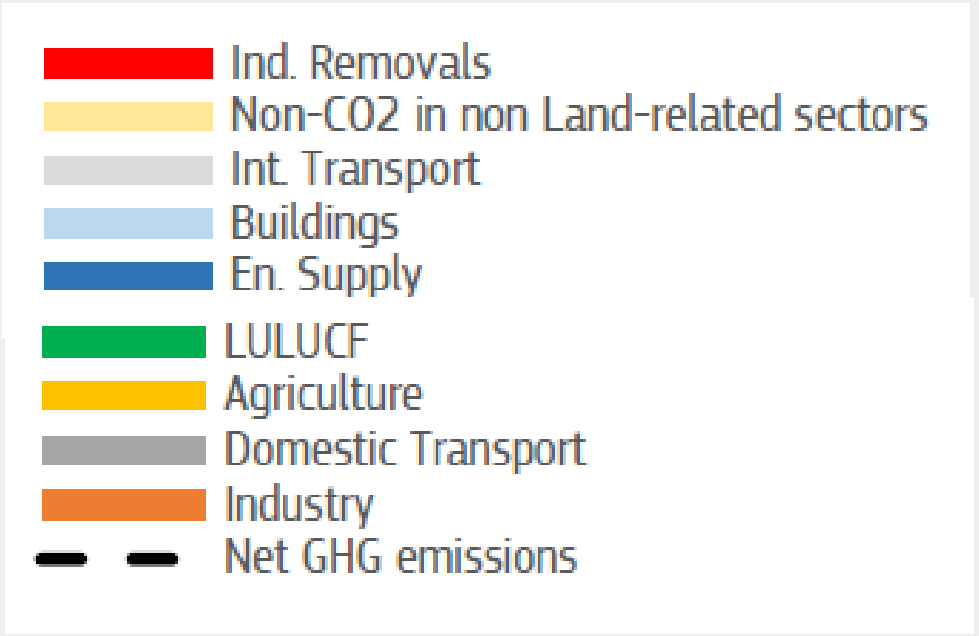
Fears of competitiveness loss and carbon leakage

- **Carbon leakage** occurs where a carbon levy induces a production reduction that is replaced by imports with possibly higher emissions intensity
- **Potential extent of leakage** varies considerably, mainly influenced by relative contributions of technical and structural mitigation and differences in emission intensities with most likely competitors
- Minimising leakage is desirable but some level of leakage is acceptable
- **Leakage can be reduced by**:
  - issuing free allowances,
  - subsidising mitigation options,
  - lowering emission reduction ambition,
  - introducing border measures,
  - facilitating dietary interventions,
  - encouraging more ambitious climate measures in third countries
  - All options come with pluses and minuses and trade-offs

Longer-term issues

Pathway to 2050 EU climate neutrality target
- agriculture is the largest source of residual emissions in 2050





Net negative emissions after 2050

Source: Commission, Impact Assessment Report accompanying Communication on EU 2040 climate target SWD(2024) 63, Annex 8, Figure 5

The strongest argument for an AgETS - managing the endgame (1)

- The existing climate architecture is not designed for a net zero endgame with significant residual agricultural emissions
- Allocating national emission budgets according to GDP per capita (with adjustments) makes sense in context of gradual emissions reductions from buildings, transport and agriculture
- Net zero gives rise to a different issue. The problem shifts from cost-effective emissions abatement to the allocation of scarce removal capacity.
- Net food exporters will require proportionately more removals, who should finance?
  - Options include production-based responsibility, consumption-based responsibility, EU-wide pooling, sector-specific treatment

Managing the endgame (2)

- An AgETS shifts the responsibility to purchase allowances to the emitter
- The question then is how do removals enter the system?
- If removals and residual emissions are integrated into a single system, then the allowance price will reflect the scarcity of removals
- Removal providers earn tradable credits, agricultural emitters purchase those credits. With current removal technologies, this cost could be very high.
- Free allowances would reduce the burden for farmer emitters, but would lower the incentive for carbon removals
- Governments may need to finance removals thus lowering their cost, is this a further subsidy to agricultural production?

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