AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

The Irish Agriculture and Food Development Authority

Scenarios and MACC Stakeholder Dialogue – Kilkenny

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Teagasc, REDP, Athenry, Galway

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Overview

- Look at 6 scenarios
- Scenarios based largely around how cow numbers might evolve in the dairy and beef herd
- Look at impact on:
  - Total Cattle Population
  - GHG emissions
  - N sales
  - Ammonia emissions
  - Milk and Beef production volumes
- **Part II of the presentation will focus on the mitigation potential**

Agricultural land area will decline

- Conventional agricultural land area decreases over time for two reasons
  1. Non agricultural uses (related to economic growth)
     - Roads, housing and other buildings
  2. Forestry and Bioenergy crops area increases
     - Afforestation: assumed increase 7,500 ha per year
     - Bioenergy crops: assumed increase 2,000 ha per year
- So even at **existing levels of ag production**
  - Production per ha **would increase** on average in future
  - As there would be less land available

Six Scenarios

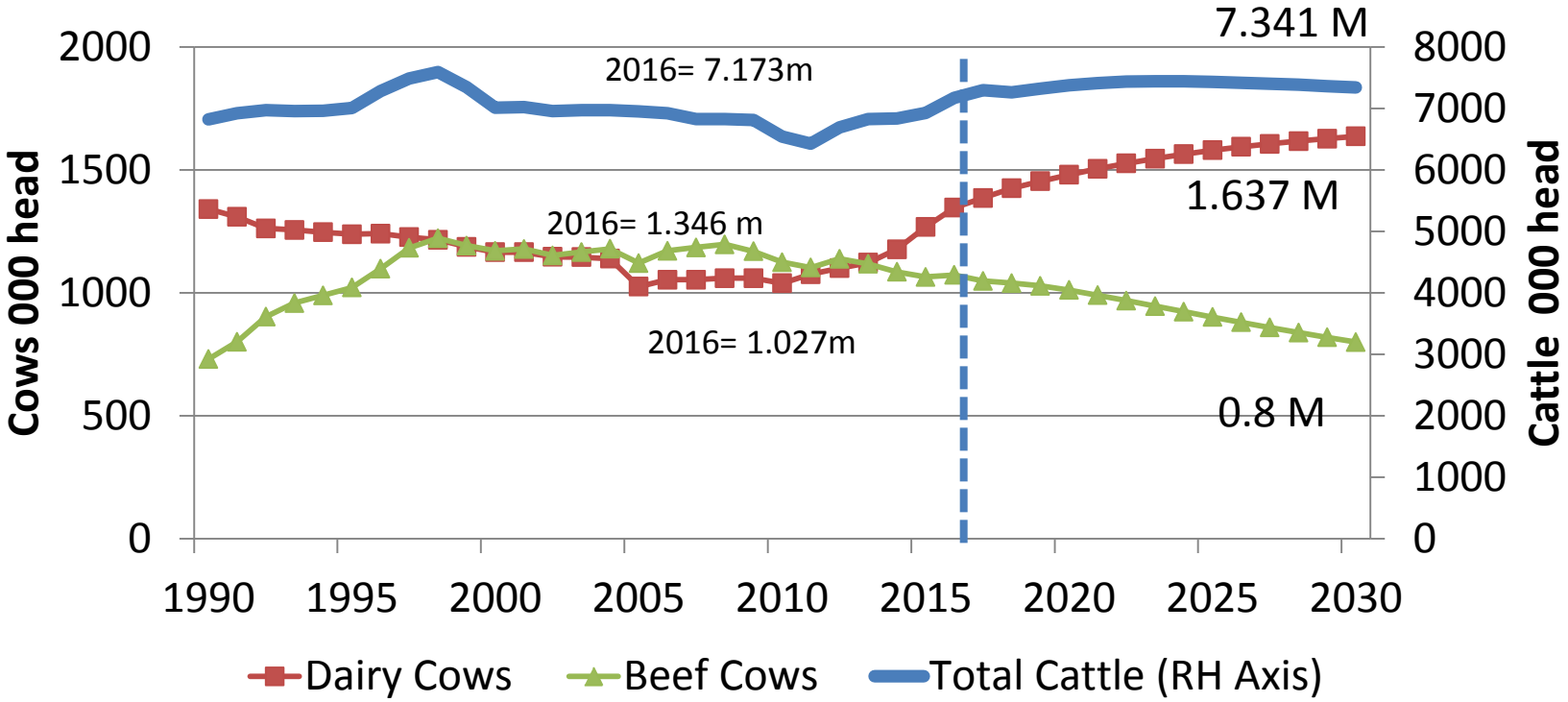
- Impossible to know future level of activity with certainty
- Depends on
  - international supply/demand -> commodity and farm prices
  - policy (Mercosur, Brexit, CAP, environment)
- Six Scenarios based around the development of the **Bovine** herd
  - principal emissions source in Irish agriculture
  - S1 – Baseline
  - S2
  - S3
  - S4 – Highest Total Cattle Population
  - S5
  - S6 – Lowest Total Cattle Population
- Scenarios move along different paths **from 2020 onwards**

Six Scenarios

implications for Total Cattle Numbers in 2030

	2005	2016	2030	2030 vs 2005	2030 vs 2016
	Million Head			% change	% change
Historical	6.951	7.173			
S1			7.342	6%	2%
S2			7.475	8%	4%
S3			7.738	11%	8%
S4			7.865	13%	10%
S5			7.018	1%	-2%
S6			6.880	-1%	-4%

S1. (Baseline)



Source: FAPRI-Ireland Model

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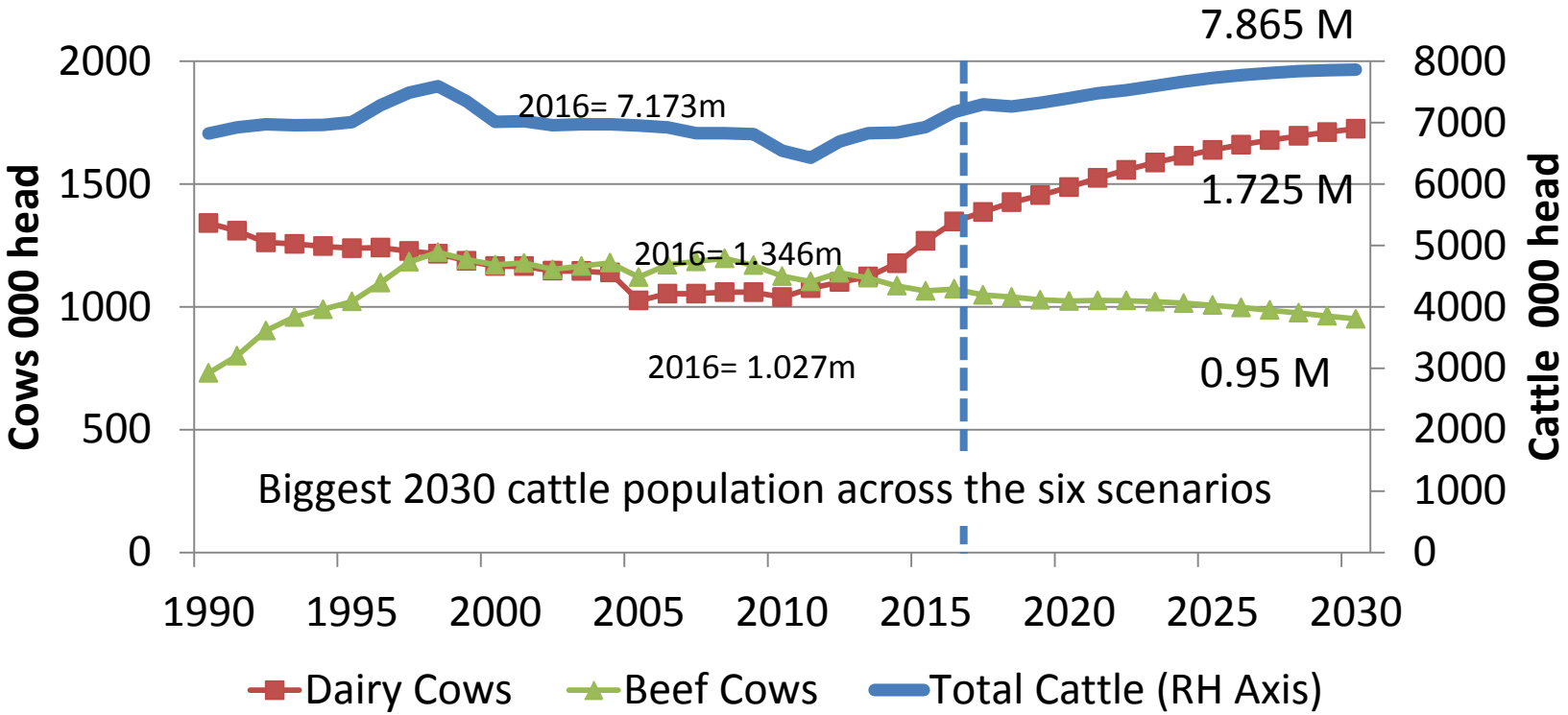
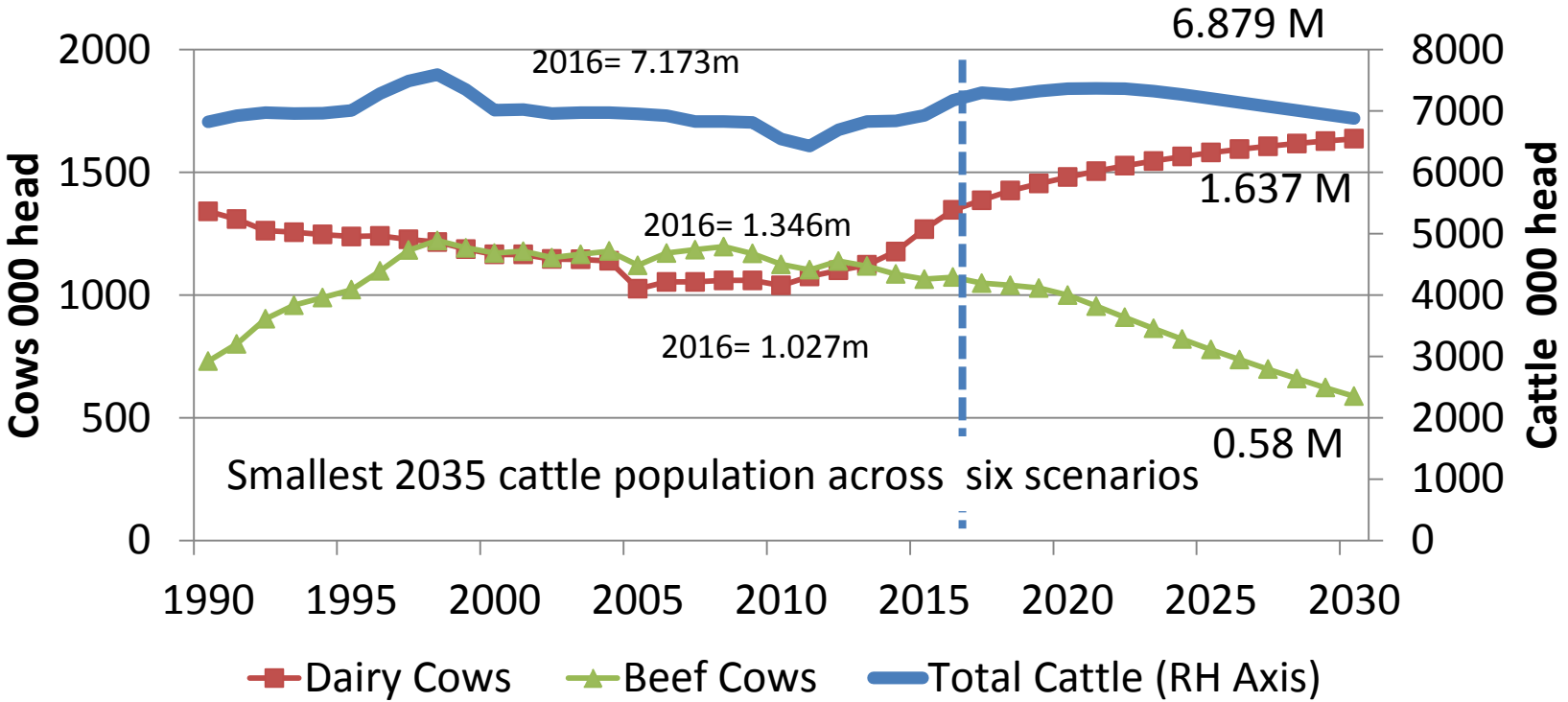
S4.



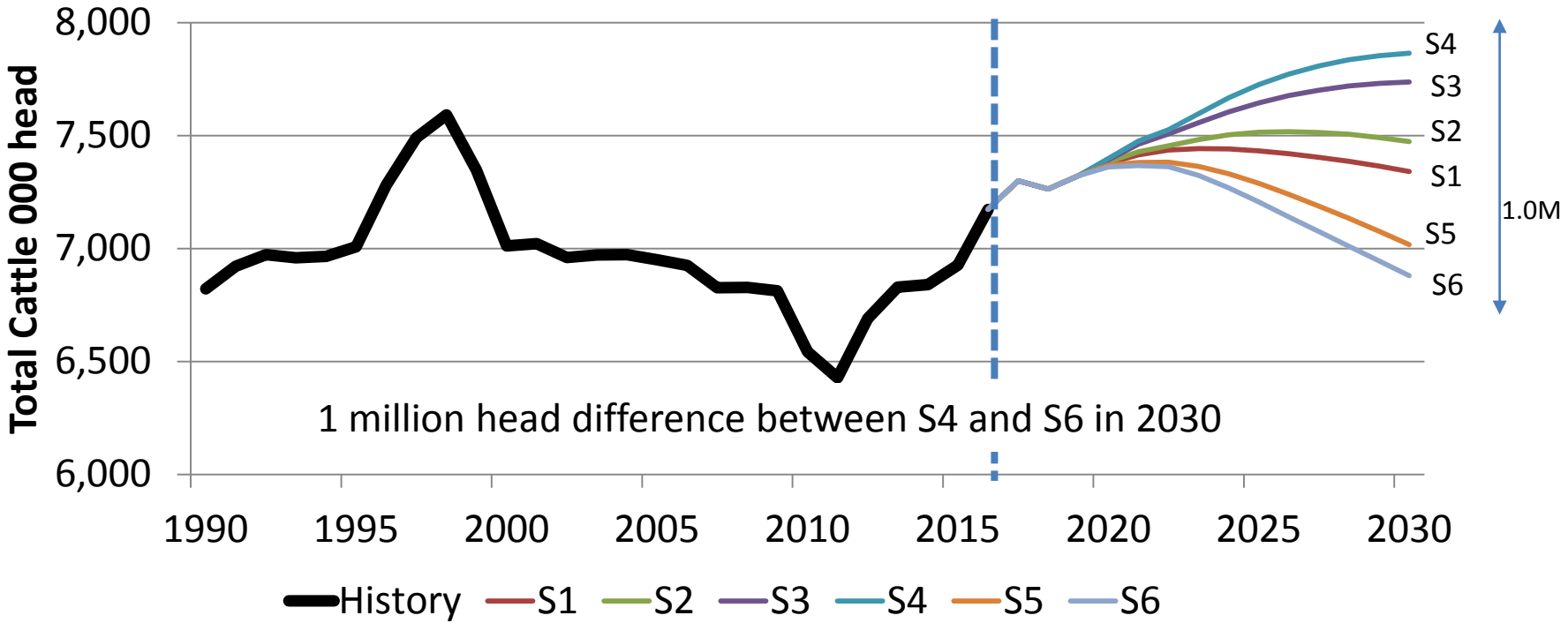
Source: FAPRI-Ireland Model

S6.



Source: FAPRI-Ireland Model

Total Cattle Population: Summary Scenarios S1 to S6



Source: FAPRI-Ireland Model

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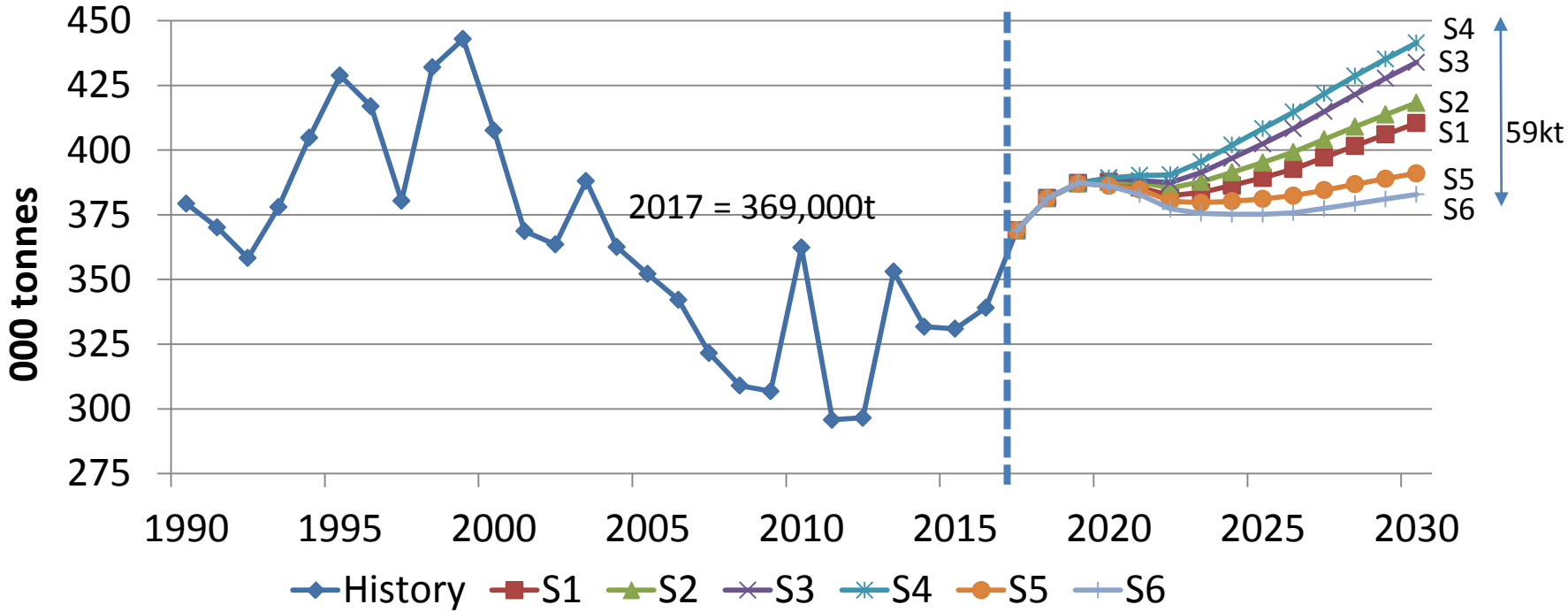
Aggregate N use: Scenarios S1 to S



NB: Big increase in N sales took place in 2017 – but not clear yet if it was all applied or stored

Source: FAPRI-Ireland Model

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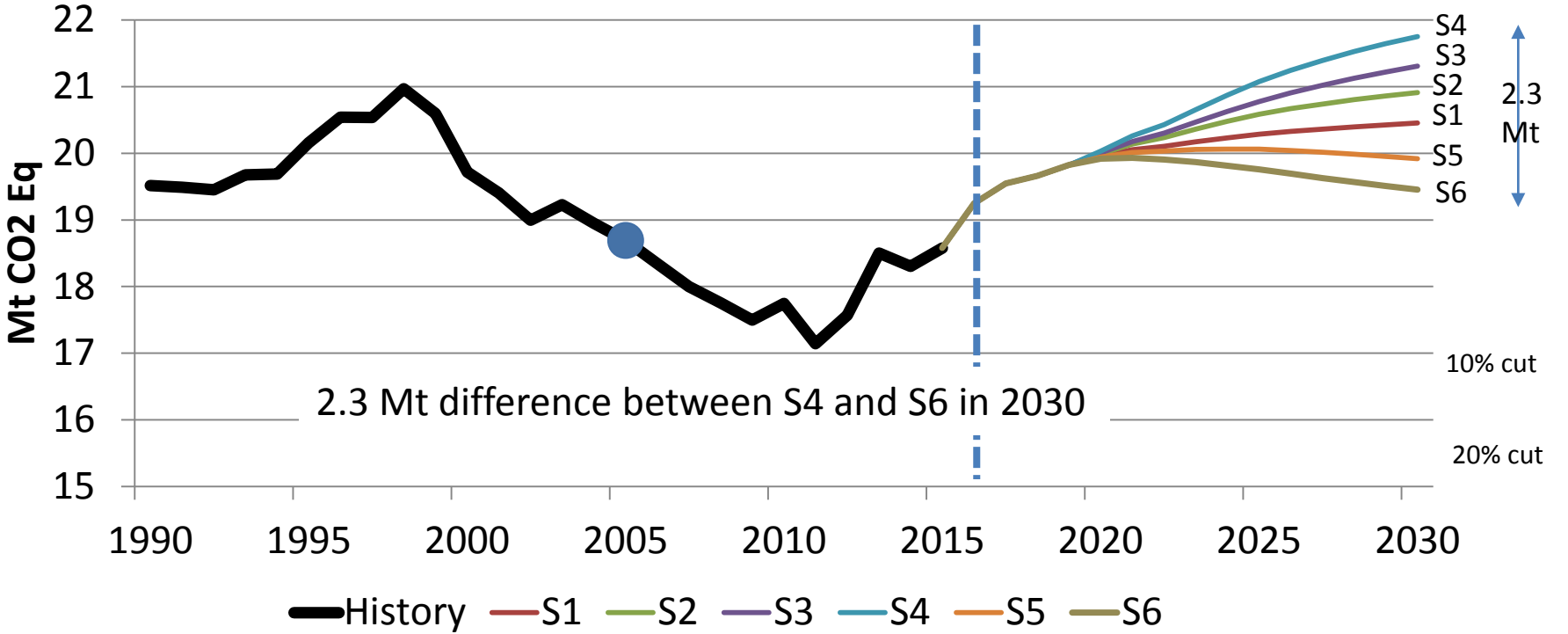
Summary: GHG emissions
NB: exclude mitigation actions



Source: FAPRI-Ireland Model

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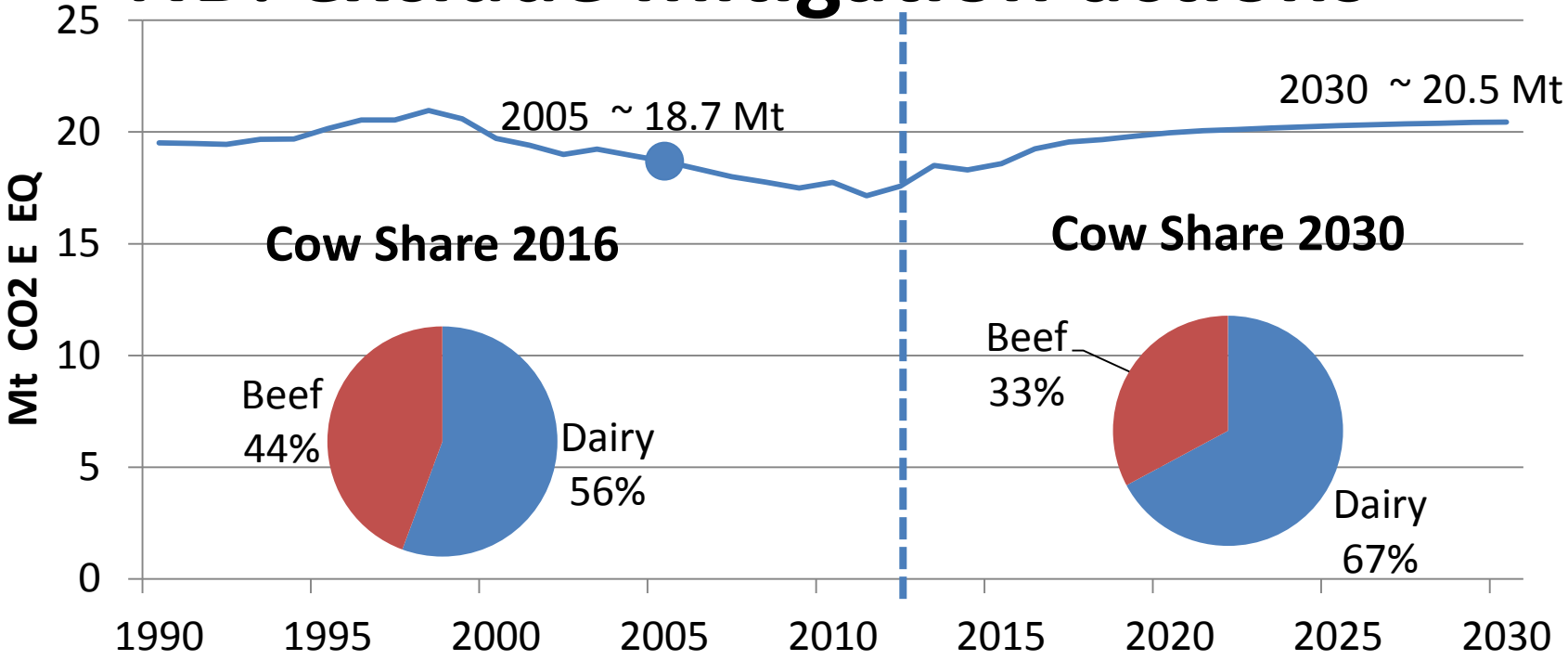
GHGS: S1. (baseline)

NB: exclude mitigation actions



Source: FAPRI-Ireland Model

Note: Excludes emissions from Fuel Combustion and Fishing which appear in the EPA "Agriculture" definition

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Six Scenarios

Implications for GHG emissions in 2030

NB: excludes mitigation actions

	2005	2016	2030	2030 vs 2005	2030 vs 2016
	Mt CO_2 eq			% change	% change
Historical	18.69	19.24			
S1			20.45	9%	6%
S2			20.91	12%	9%
S3			21.31	14%	11%
S4			21.75	16%	13%
S5			19.92	7%	4%
S6			19.45	4%	1%

Evolution of GHG emissions cross the six scenarios

NB: excludes mitigation actions

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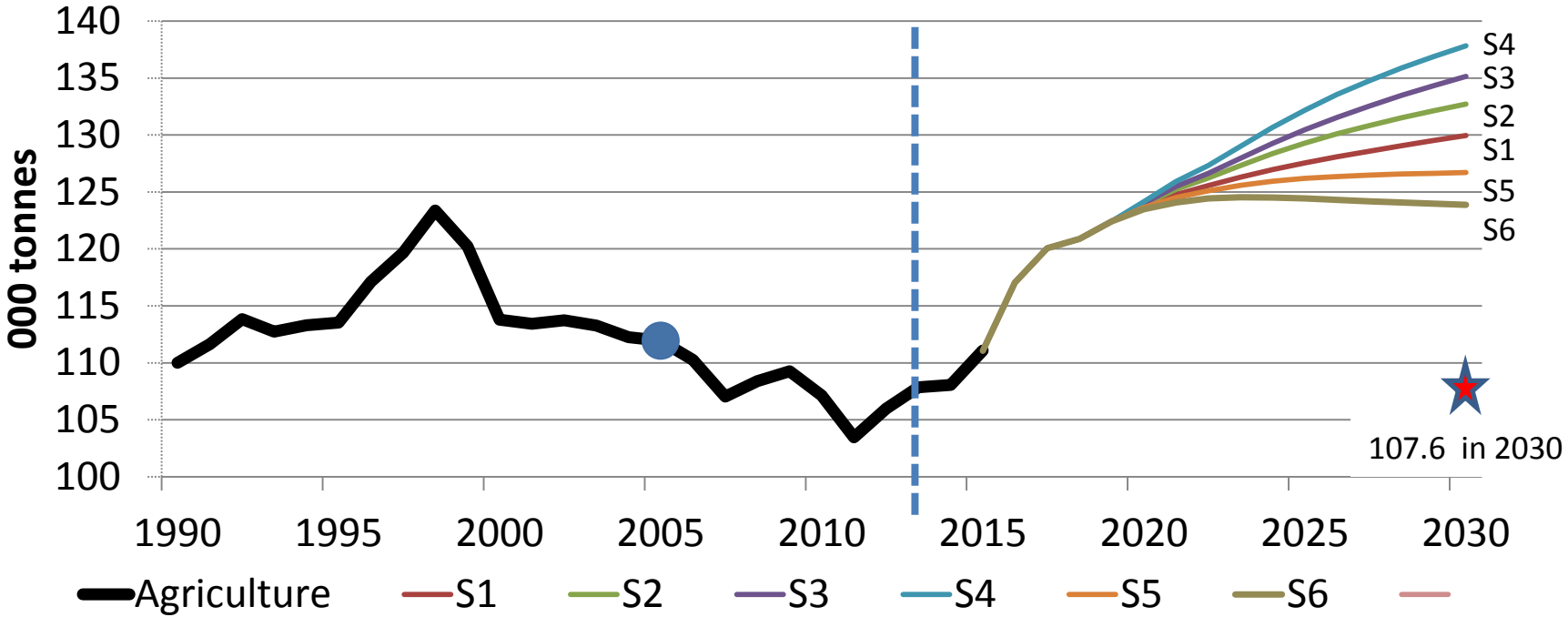
Summary: Ammonia emissions (NB: excludes mitigation actions)



Source: FAPRI-Ireland Model

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Six Scenarios

Implications for Ammonia emissions in 2030

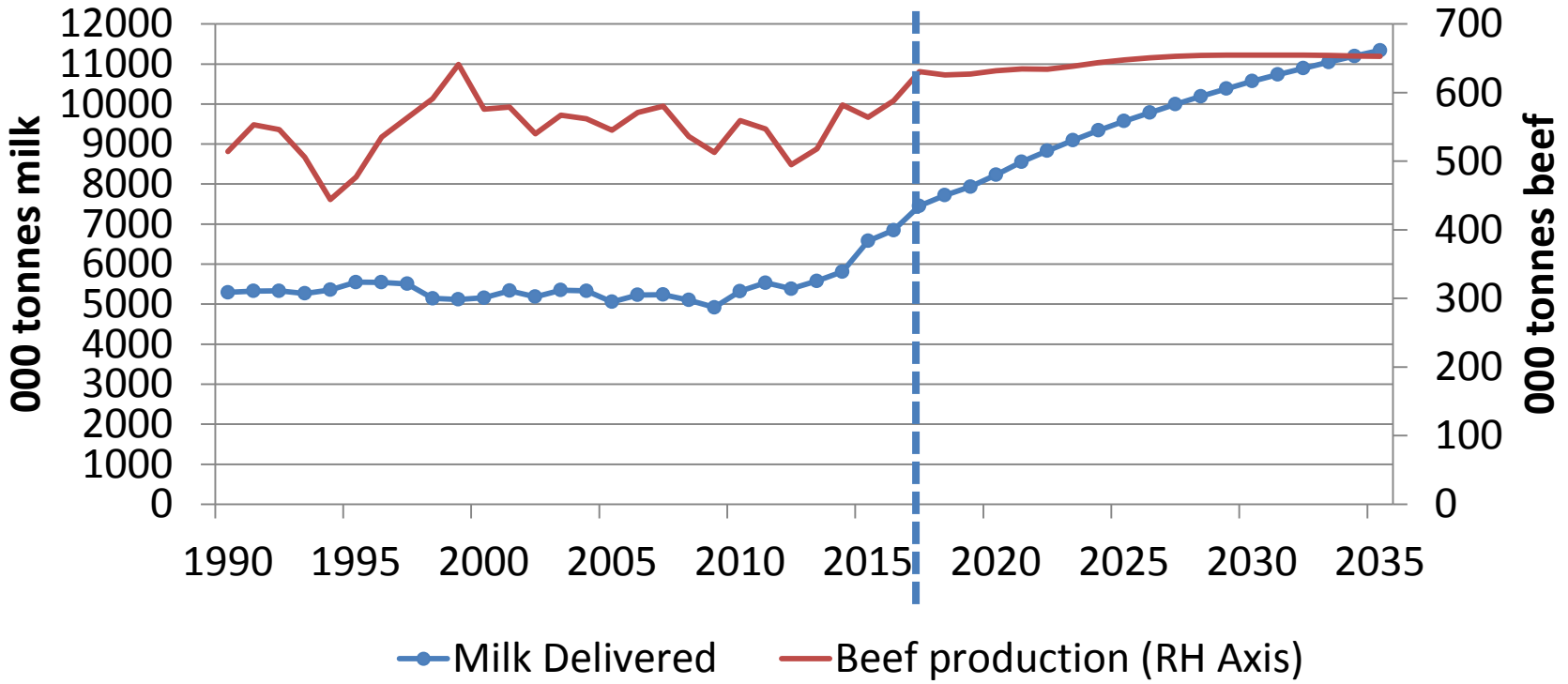
NB: excludes mitigation actions

	2005	2016	2030	2030 vs 2005	2030 vs 2016
	Kt NH_3			% change	% change
Historical	111.95	117.03			
S1			129.95	16%	11%
S2			132.70	19%	13%
S3			137.14	23%	17%
S4			137.82	23%	18%
S5			126.70	13%	8%
S6			123.87	11%	6%

Evolution of GHG emissions cross the six scenarios

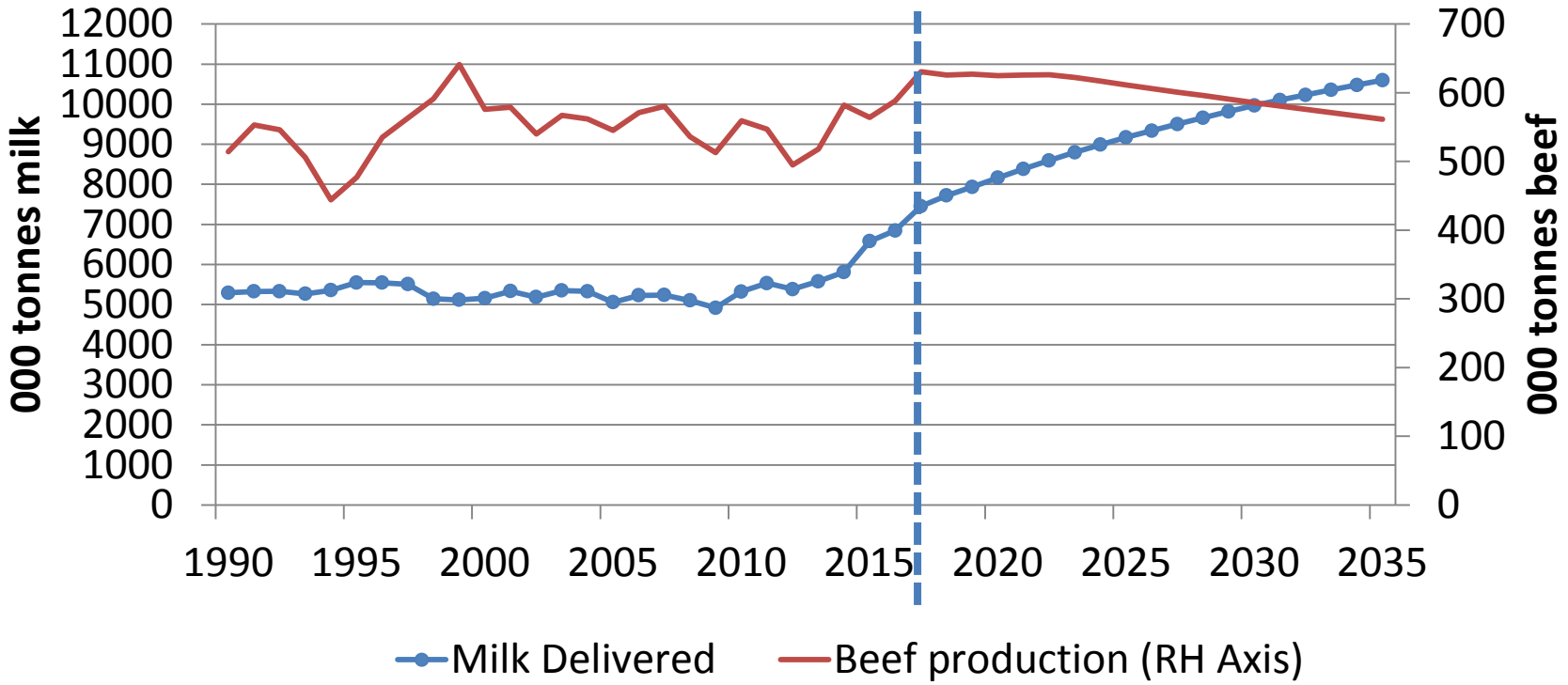
NB: excludes mitigation actions

S4: Milk and Beef Production



Source: FAPRI-Ireland Model

S6: Milk and Beef Production



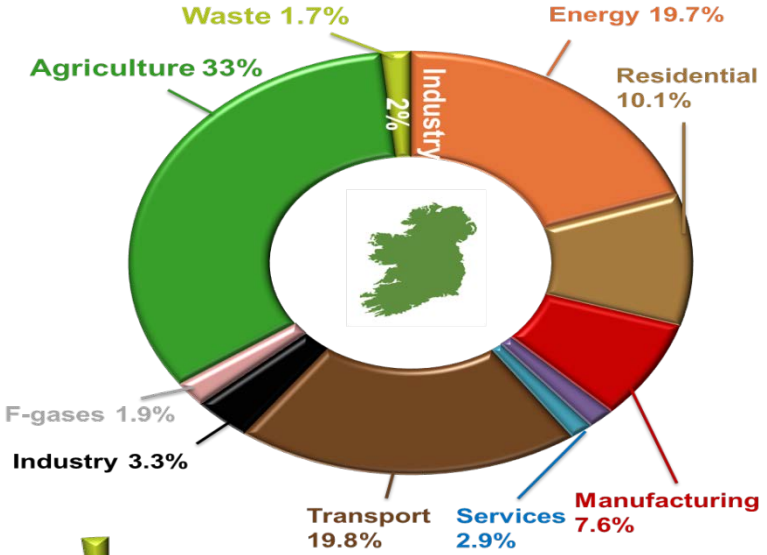
Source: FAPRI-Ireland Model

Conclusions

- Scenario analysis makes clear that emissions are likely to increase
  - In the absence of mitigation actions
- The rate of increase in ammonia emissions is higher than for GHGs
- One of these reduction targets may become the binding constraint in terms of the size of the sector

GHG– The Challenges

- Irish agriculture comprises 45% of non-ETS GHG
- **GHG targets:**
  - 20% emissions reduction by 2020
  - 30% non-ETS reduction by 2030 (2030 Effort Sharing)
    - with 10% allowable to flexible mechanisms
- Both GHG and ammonia emissions projected to increase by 2030
- **Ammonia targets:**
- 98% of ammonia emissions from Ag
  - 1% reduction to 2030
  - 5% from 2030 onwards
  - ammonia mitigation can be synergistic or antagonistic with GHG mitigation



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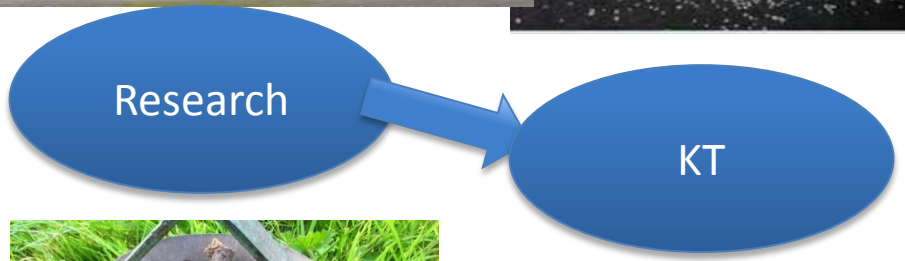
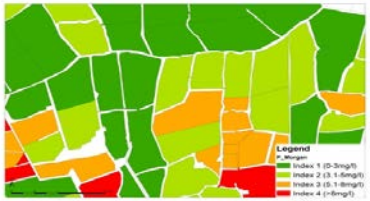
The Solutions

- Reduce methane
  - animal genetics
  - extended grazing and diet
- Fertilisers and nutrient use –
- Protected urea can reduce N_2O substantially
- Improving liming,
  - N & P-use fertiliser reduced
- Manure additives
  - can reduce ammonia and methane by 70-80%

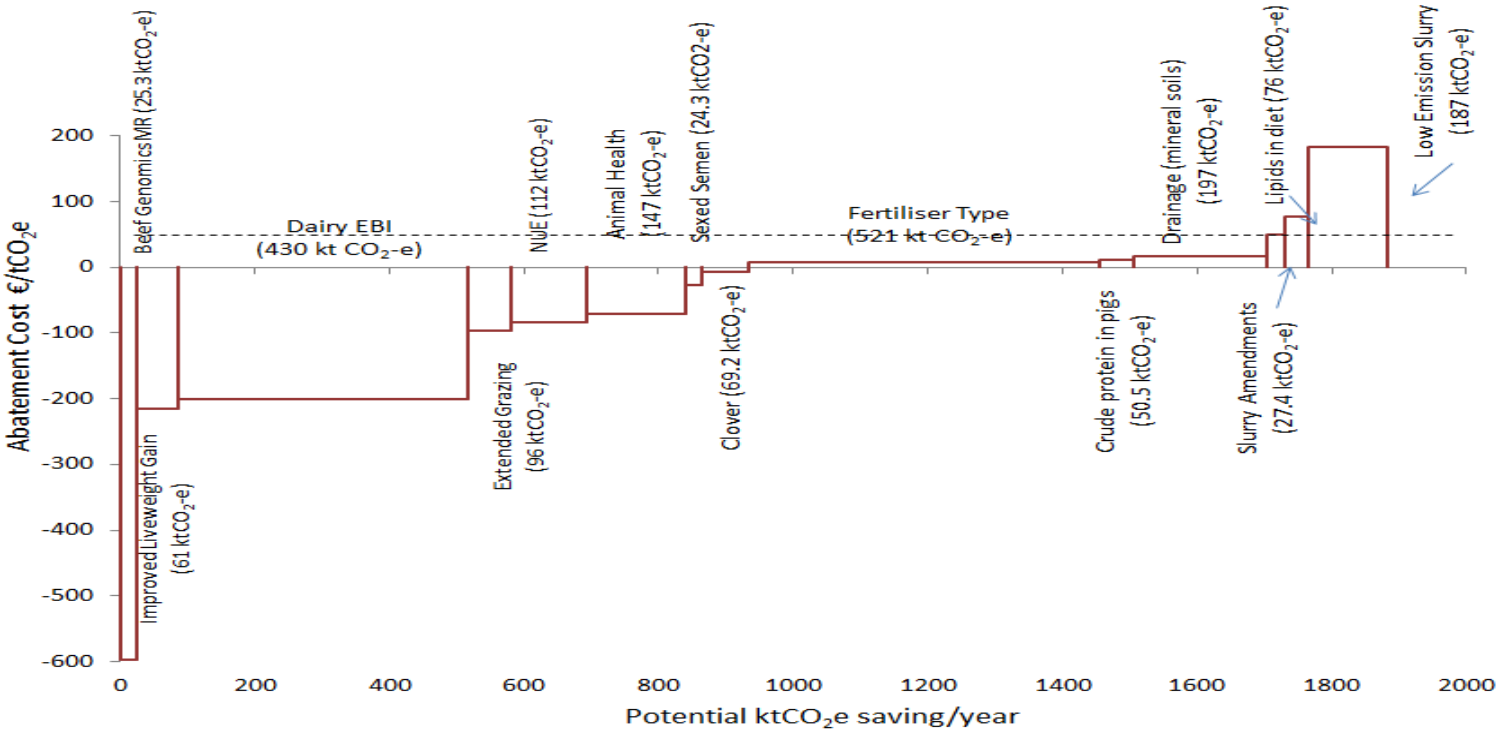
But need effective knowledge transfer -





MACC – Agricultural Abatement

- Marginal Abatement Cost Curve for agriculture for 2021-2030 (direct methane and nitrous oxide abatement). Values are based on linear uptake of measures between the years 2021-2030.



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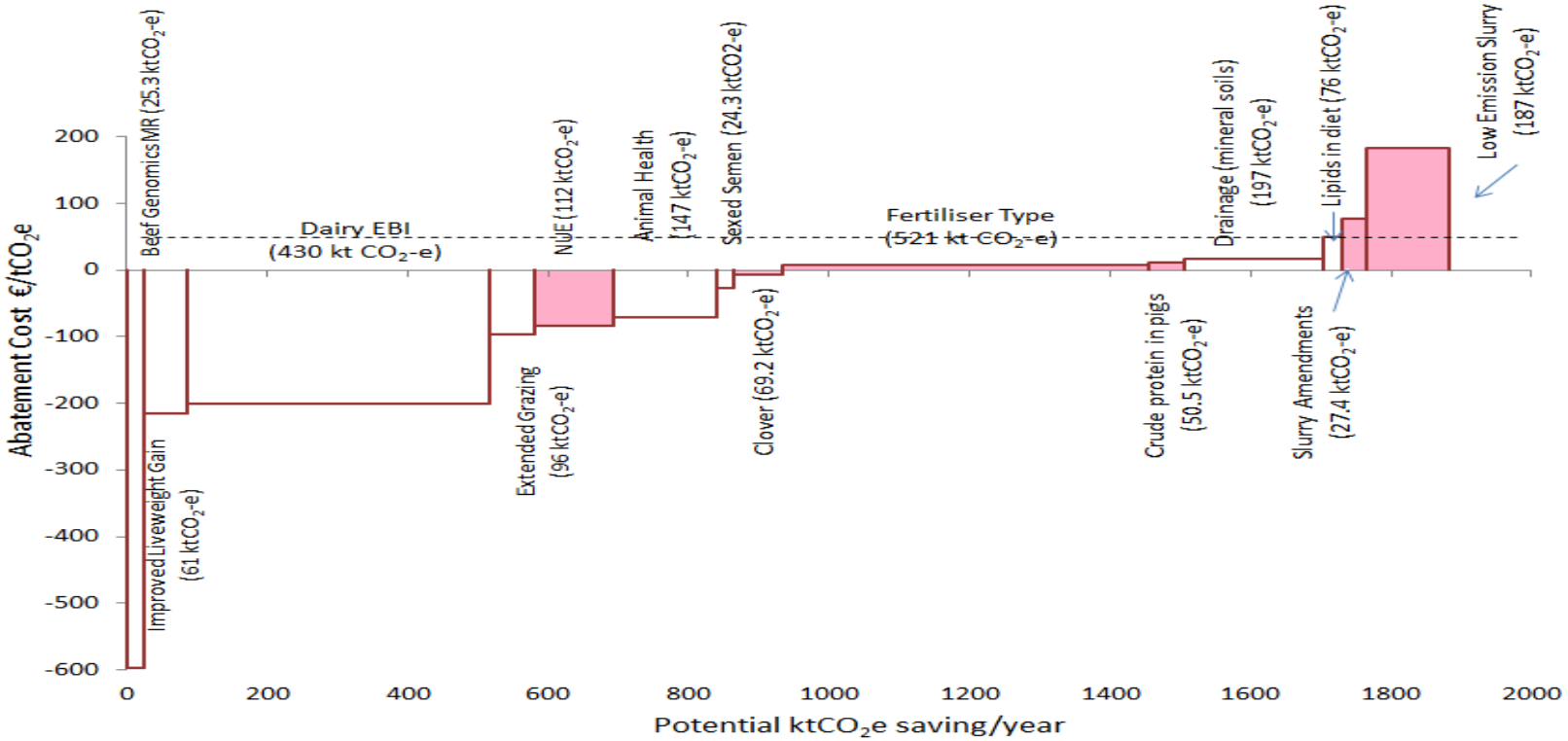

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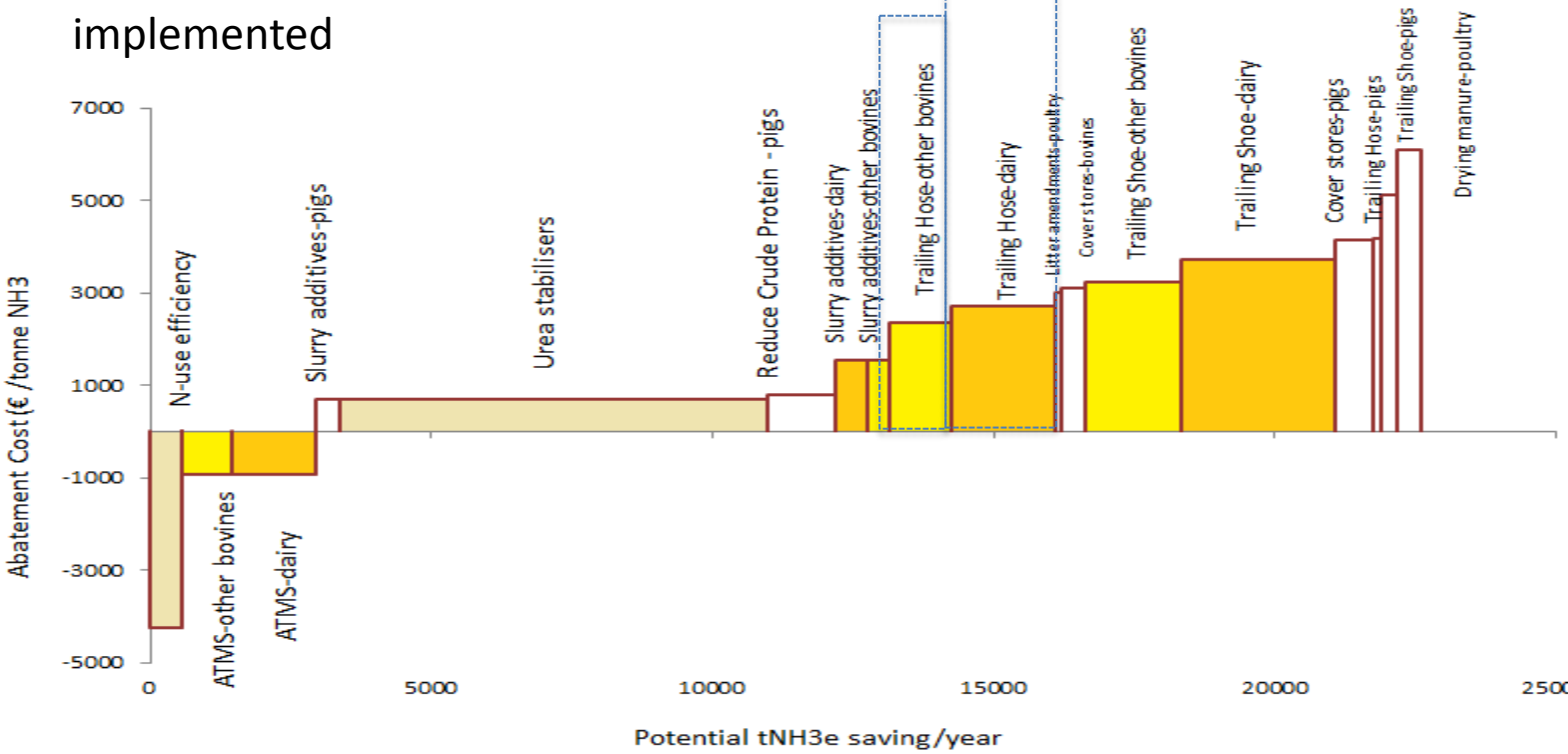
Ammonia MACC

- Total achievable reduction is 22.5 t NH_3
- Cost varies from 41-78M per annum depending on how landspreading measures are implemented



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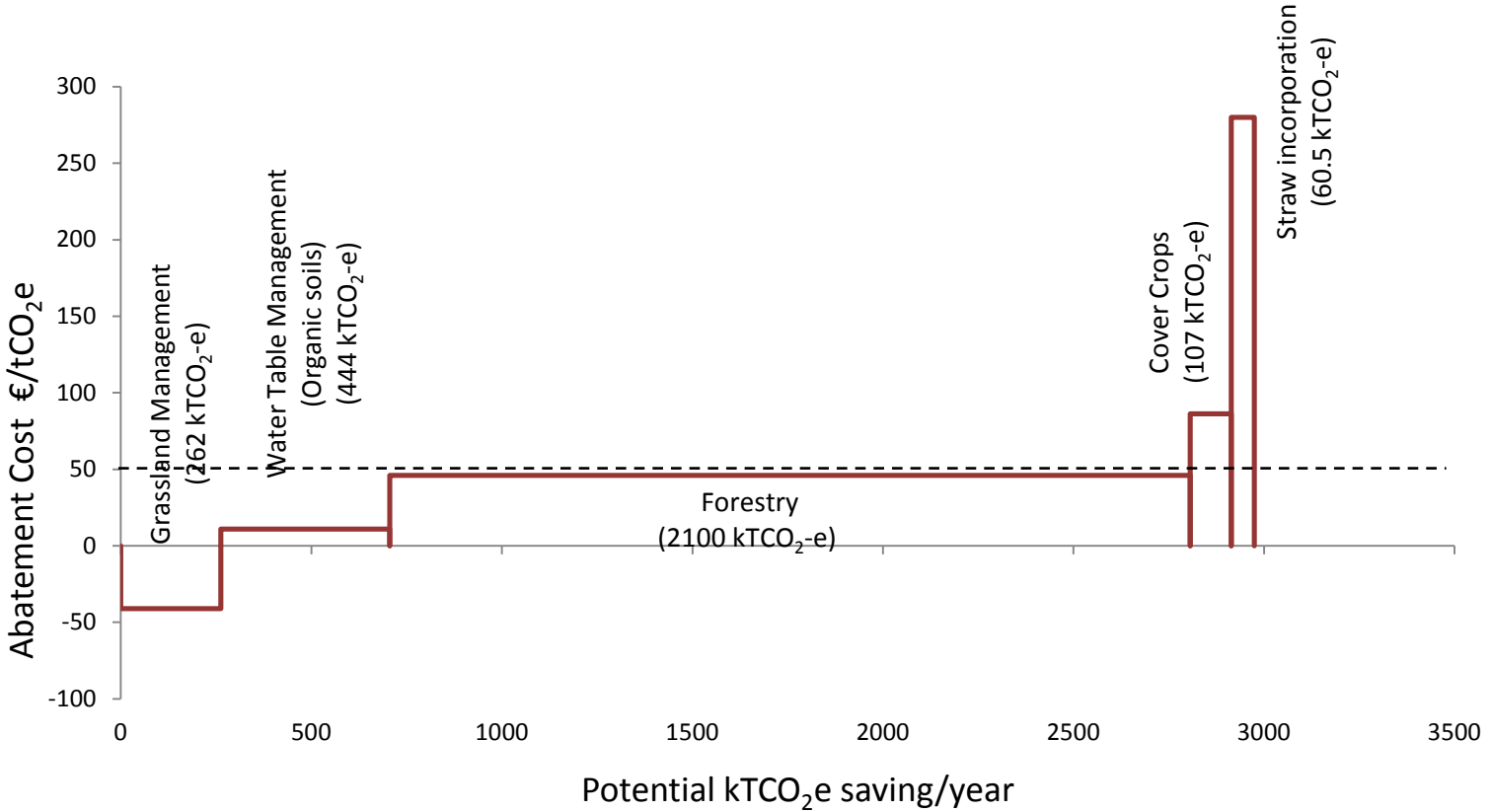
LULUCF

- Under flexibilities only 26.8 M tonnes CO_2 can be banked
- Huge scope in Ireland to ‘elect’ more sequestration- particularly in ‘organic soils’ category

Land-use measure



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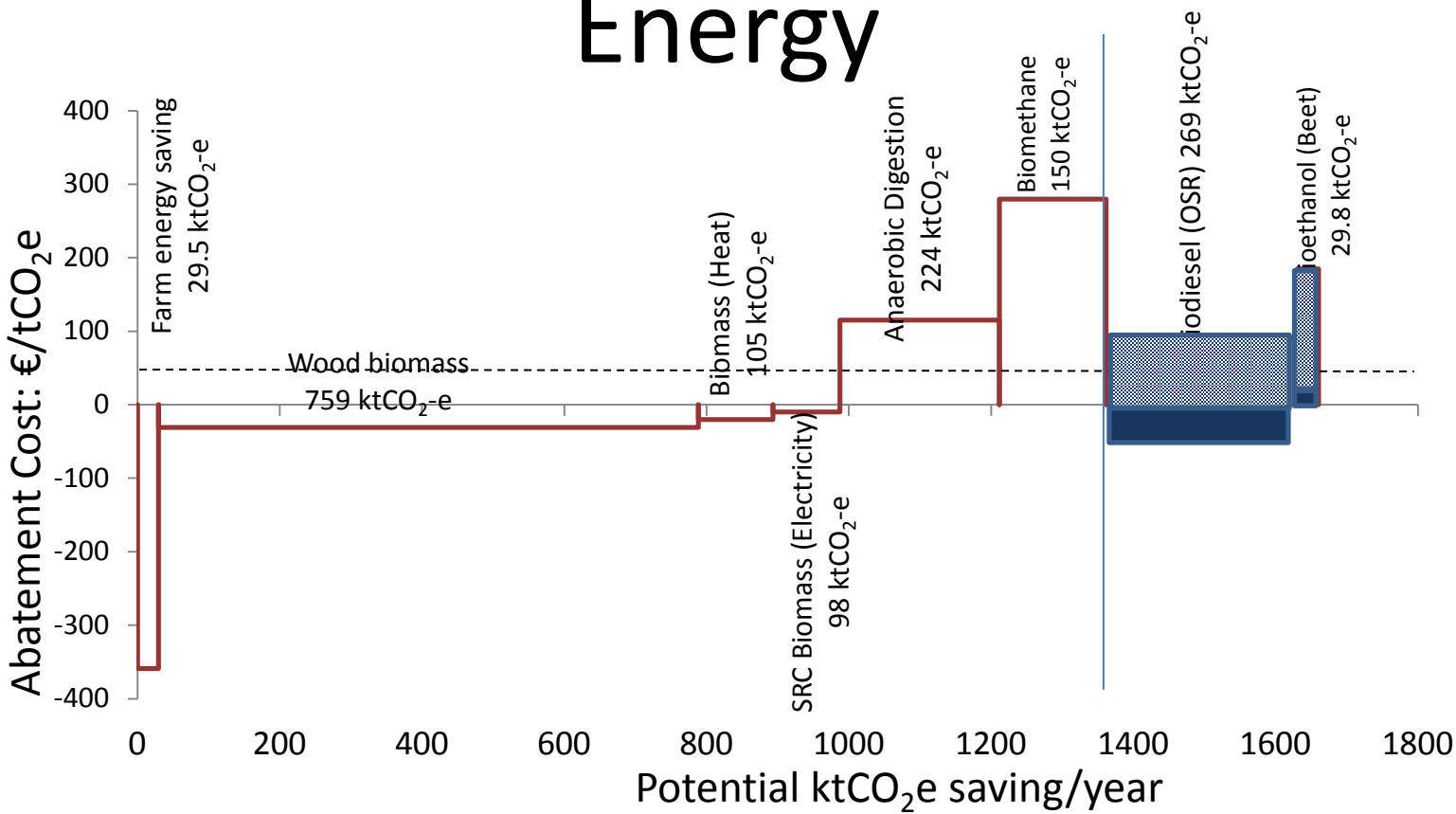
Energy

- Estimates are very uncertain
- Energy saving is an easy win and should be pursued first
- Bioenergy uptake is far more uncertain
  - but can be fundamental to de-carbonisation given proper conditions.

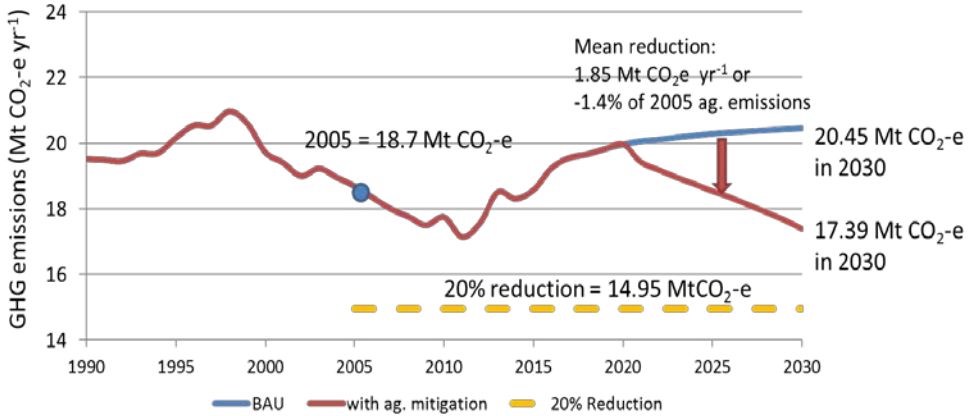
Energy

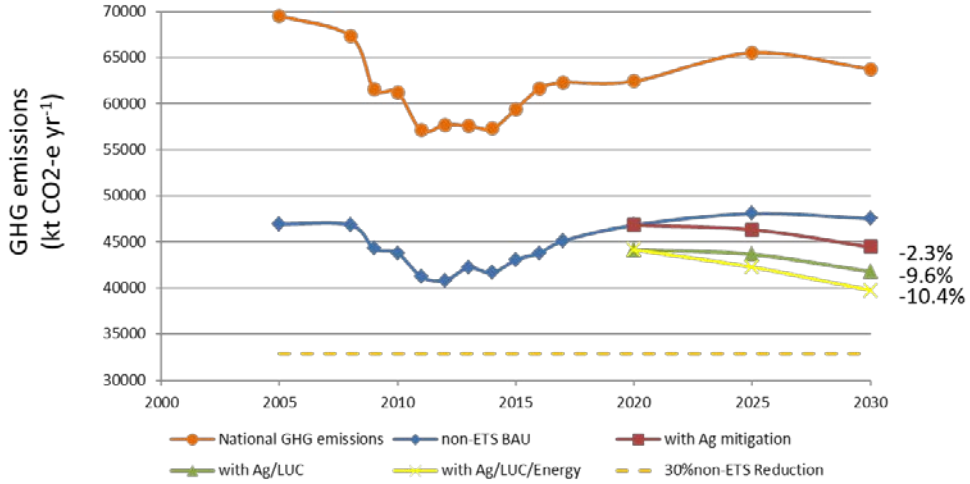

Abatement Cost: €/tCO2e
400
300
200
100
0
-100
-200
-300
-400
0
200
400
600
800
1000
1200
1400
1600
1800
Potential ktCO2e saving/year
Farm energy saving 29.5 ktCO2-e
Wood biomass 759 ktCO2-e
Biomass (Heat) 105 ktCO2-e
SRC Biomass (Electricity) 98 ktCO2-e
Anaerobic Digestion 224 ktCO2-e
Biomethane 150 ktCO2-e
Biodiesel (OSR) 269 ktCO2-e
Bioethanol (Beet) 29.8 ktCO2-e

Conclusions

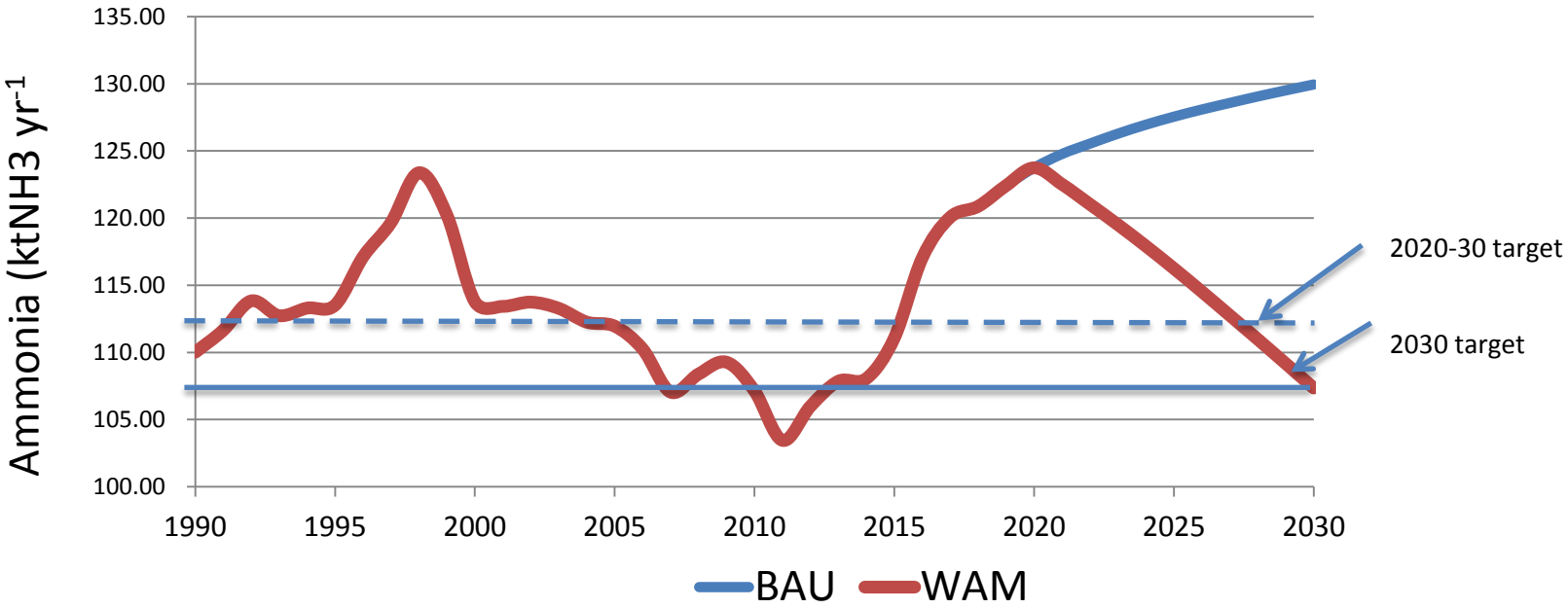
- Ammonia and water quality are as pressing as GHG

- However, reputational damage may be a bigger cost than fines or purchasing compliance





Compliance with ammonia may not be achieved until 2026-2027 unless uptake is increased



Conclusions

- Biophysical agricultural mitigation will NEVER go beyond a mean 3-4 MT CO_2-e yr^{-1}
  - In the absence of a methane ‘silver bullet’.
- Further technical abatement of methane is possible
- C sequestration can deliver more
  - but can be a double-edged sword
- Mitigation will not absorb projected increase in activity
- May be in breach of NECD for a considerable period