Land-use change as a mitigation option

NZ Agricultural Climate Change Conference

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Motu Economic and Public Policy Research and Environmental Defense Fund

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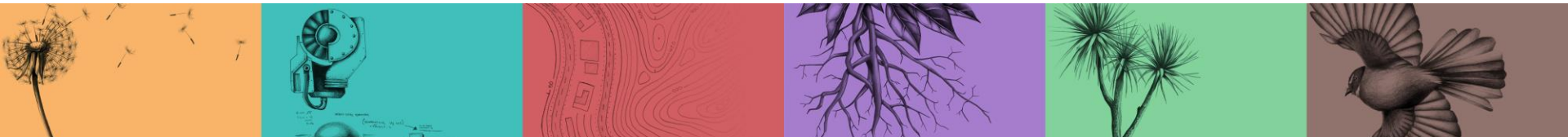

Outline

On-farm versus land-use change

- Learning how to mitigate emissions within ruminant farm systems is globally valuable if others are going to keep doing ruminant farming (which they probably are for a long time)
- But do we neglect land-use change as a valuable option?

Two pieces of work:

1. Cows, cash and climate: Low stocking rates, high performing cows, emissions and profitability across New Zealand farms
2. Land-use Change as a Mitigation Option for Climate Change

Cows, cash and climate

With David Fleming (CSIRO) and Edmund Lou (Northwestern)
Thanks to NZAGRC for funding

Two hypotheses

1. High performing animals (more milk solids per cow) will have lower emissions intensity with no loss of profit – or even a gain.

2. If these farms lower their stocking rates they will also deliver absolute emission reductions at no-cost.

Data

MAF Monitor Farm Database

Overseer files + financial data

144 dairy farms around NZ – 2009-2012

222 total observations

Not a random sample

Regression results

	SUR regression	
	Emissions intensity	Milk profitability
Stocking rate (SR)	-1.11 ***	-111.981
Milk solids per cow (AP)	-13.5 ***	2,308.73 **

Other controls: Use of irrigation; Use of feed pad; Use of DCD; Hay and silage feed expenses per cow; Animal health expenditure per cow; Depreciation per cow; Number of supplements imported; Log of total effective area; rainfall, temperature, topography (dummy variables for easy hill, rolling hill and steep hill), soil type (dummy variables for peat, podzol, pumice, recent YGE, sands and volcanic), region (dummy variables for Canterbury, Northland, Southland, Taranaki, and Waikato and Bay of Plenty)

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Analysis of farm data:

1. supports the hypothesis that increasing animal performance (MS per cow) is a no-cost mitigation option.

If we raise MS per cow by 60kg (1 Std dev)

emissions intensity falls

profit rises by $618 per ha, but

absolute emissions rise by 1.6 tons CO_2-e per ha

How do we best lower absolute emissions: lower stocking rates, close average farms, close least profitable farms?

3 ‘experiments’ – emissions fall to original level in all cases

1. Lower stocking rate: profit loss = $ 396 per ha (< $618)

   Yes – high MS per cow with low stocking rate is more profitable than current (on average)

2. Close average farms: profit loss = $ 512 per ha

   But the land can be used for something else

And what if we close the farms that get the least profit per ton of CO_2?

3. Close low profit farms: profit loss = $ 396 per ha

   And get to use the land for something else!

Modelling mitigation through land use change

Land-use Change as a Mitigation Option for Climate Change

With Zack Dorner, Utkur Djanibekov, Tarek Soliman, Adolf Stroombergen, David A. Fleming, Sandra Cortes-Acosta, and Suzie Greenhalgh

Thanks to the Biological Emissions Reference Group

Three mitigation targets

1. Reference

   (no additional ambition for land sector – existing ETS only);

2. Low-ambition (LA) scenario

   (15% net land-sector emissions reduction by 2030 – 25% by 2050); and

3. High-ambition (HA) scenario

   (30% net land-sector emissions reduction by 2030 – 50% by 2050).

Assumptions about land-use

1. Reference (no horticultural expansion)

2. "Growing horticulture" (LH)

   (20% expansion of horticultural land (100,000 ha) by 2030 and 40% (200,000ha) by 2050) LURNZ

3. "Horticultural transformation" (HH)

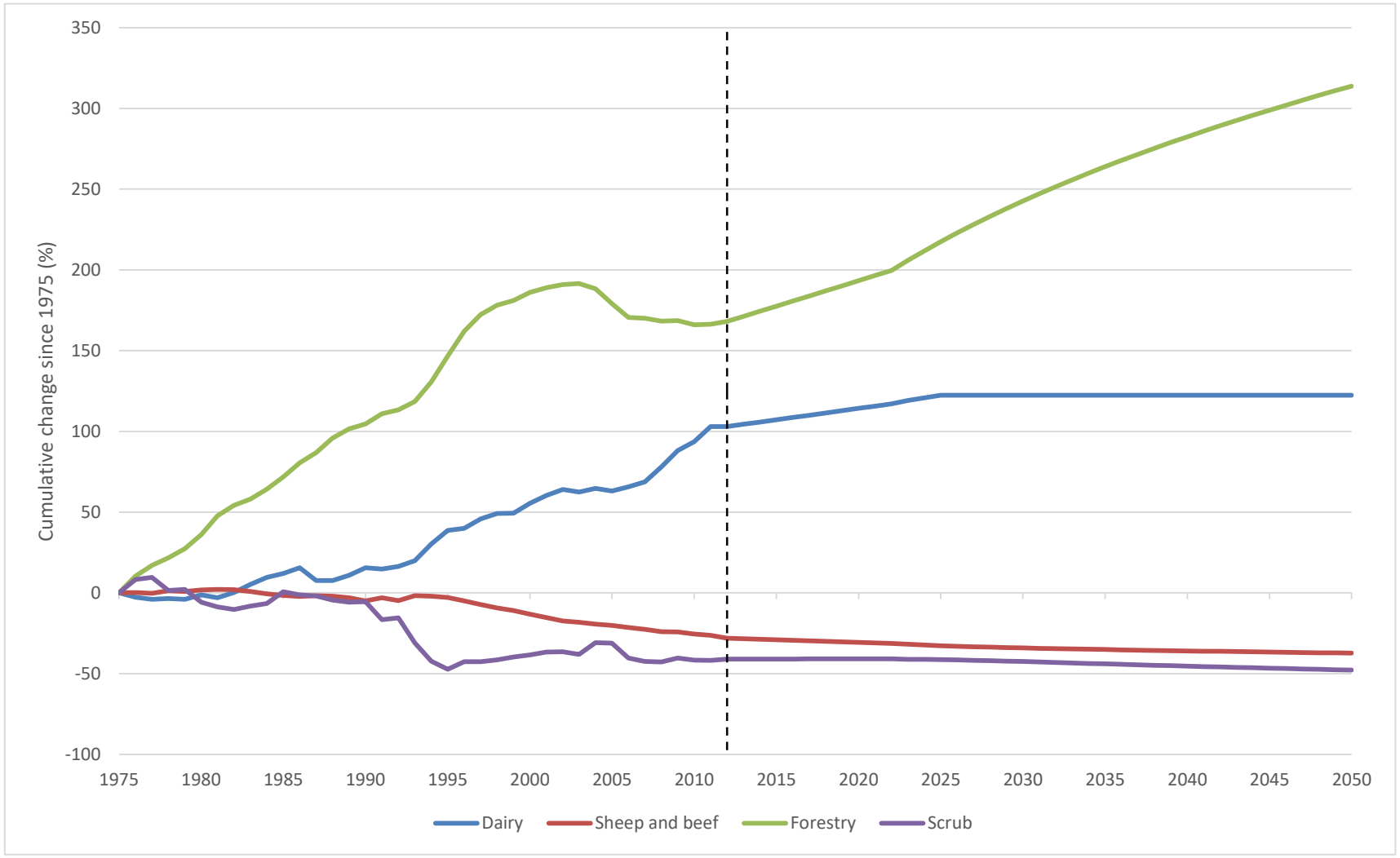
   (100% expansion of horticultural land (500,000 ha) by 2030 and 200% (1 million ha) by 2050) in LURNZ

4. Mitigation technology breakthrough (Mit)

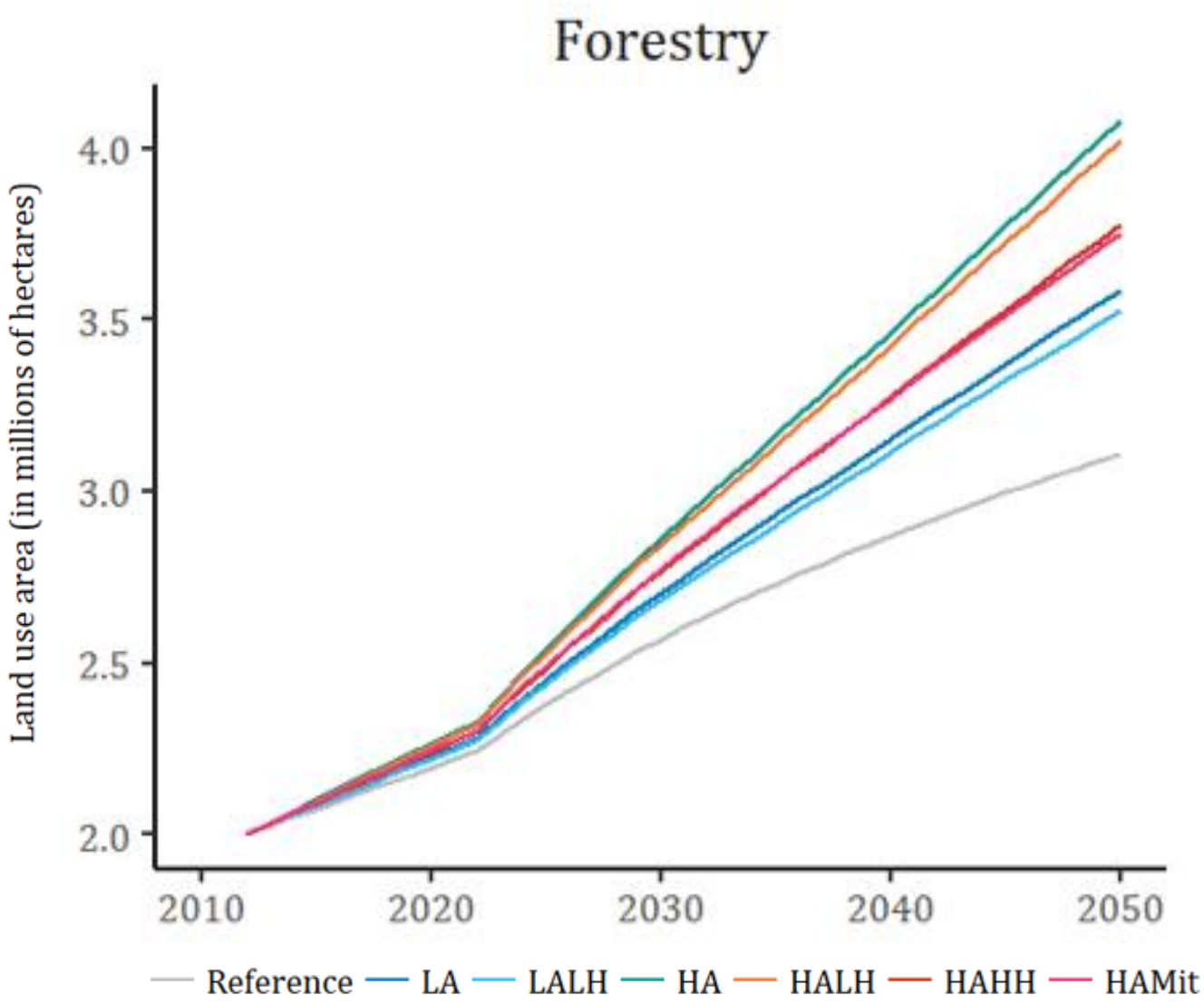
   in 2030 (reduces dairy livestock emissions 30%, sheep-beef by 20%)

Reference case land use

% change since 1975

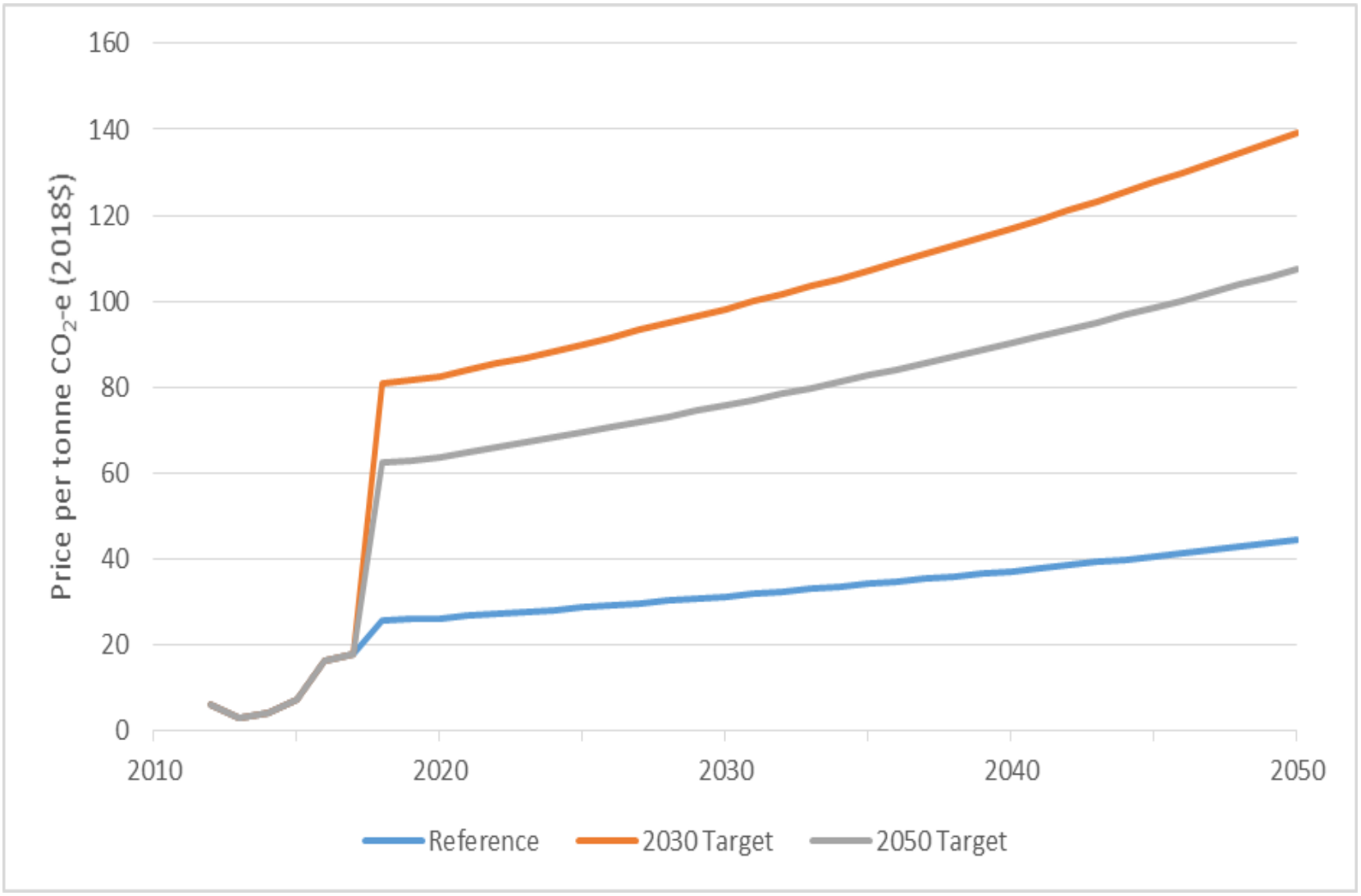


Net emissions changes driven by forestry

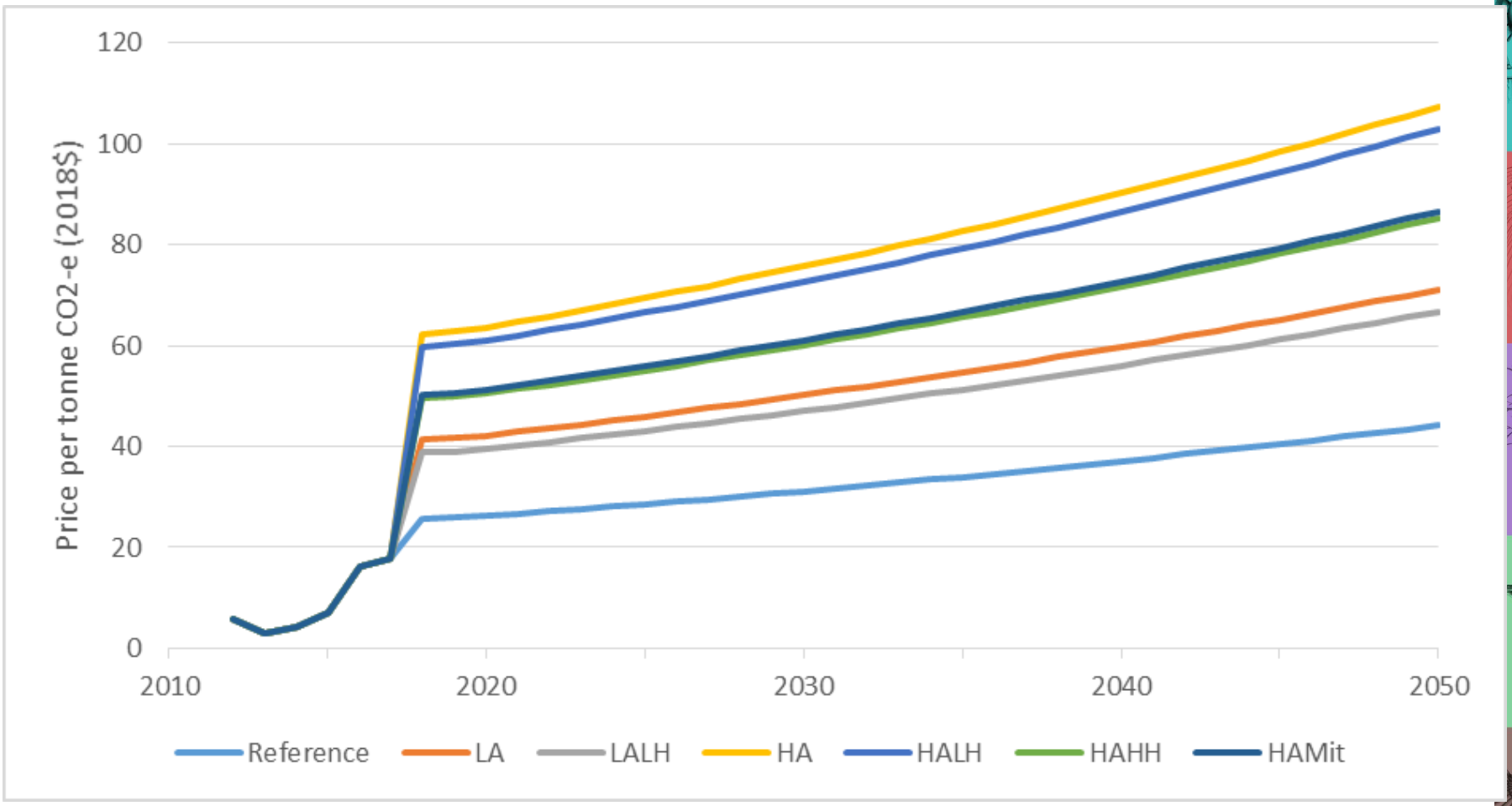


2030 target harder to achieve than 2050

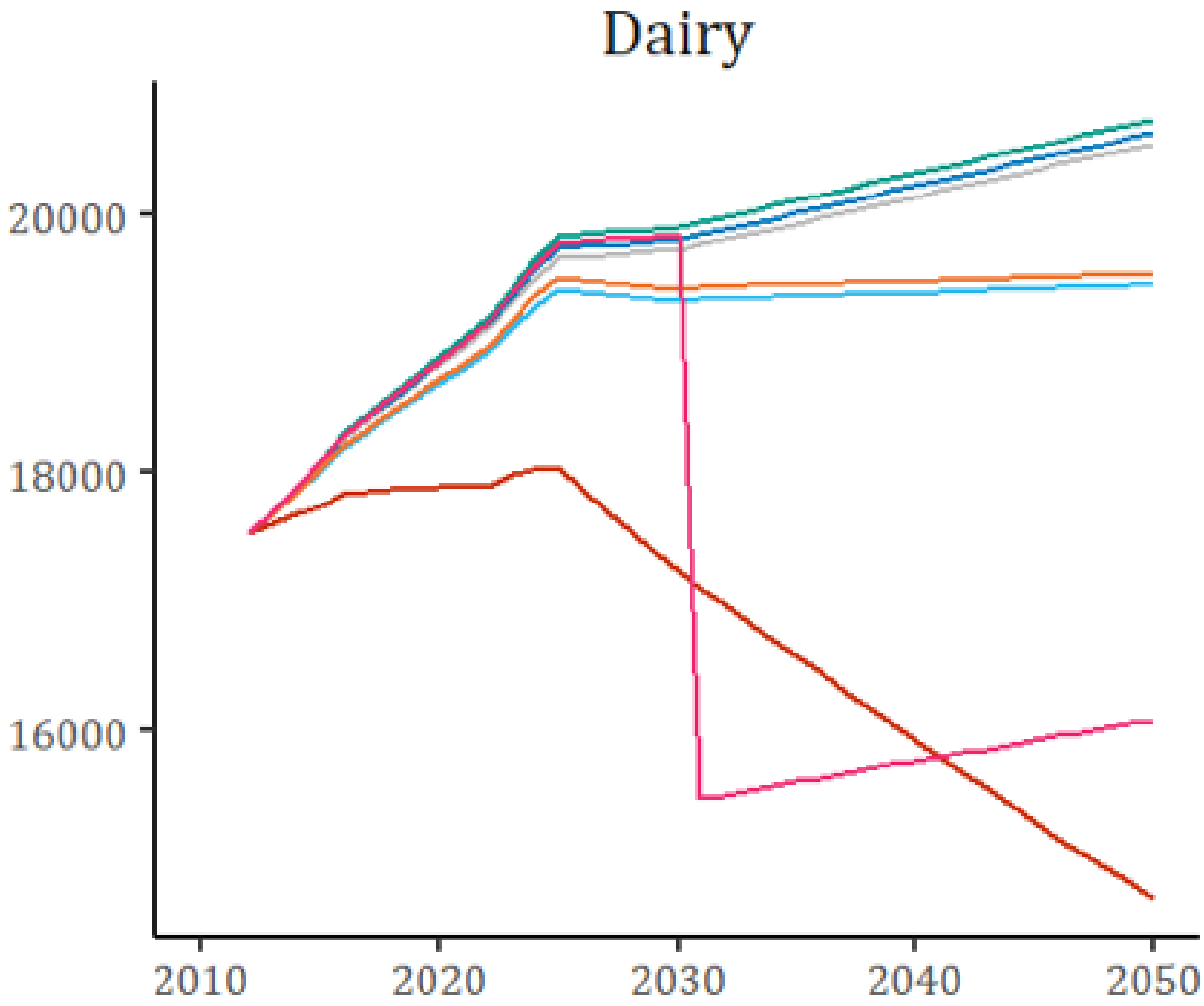
implicit emissions prices 2018$



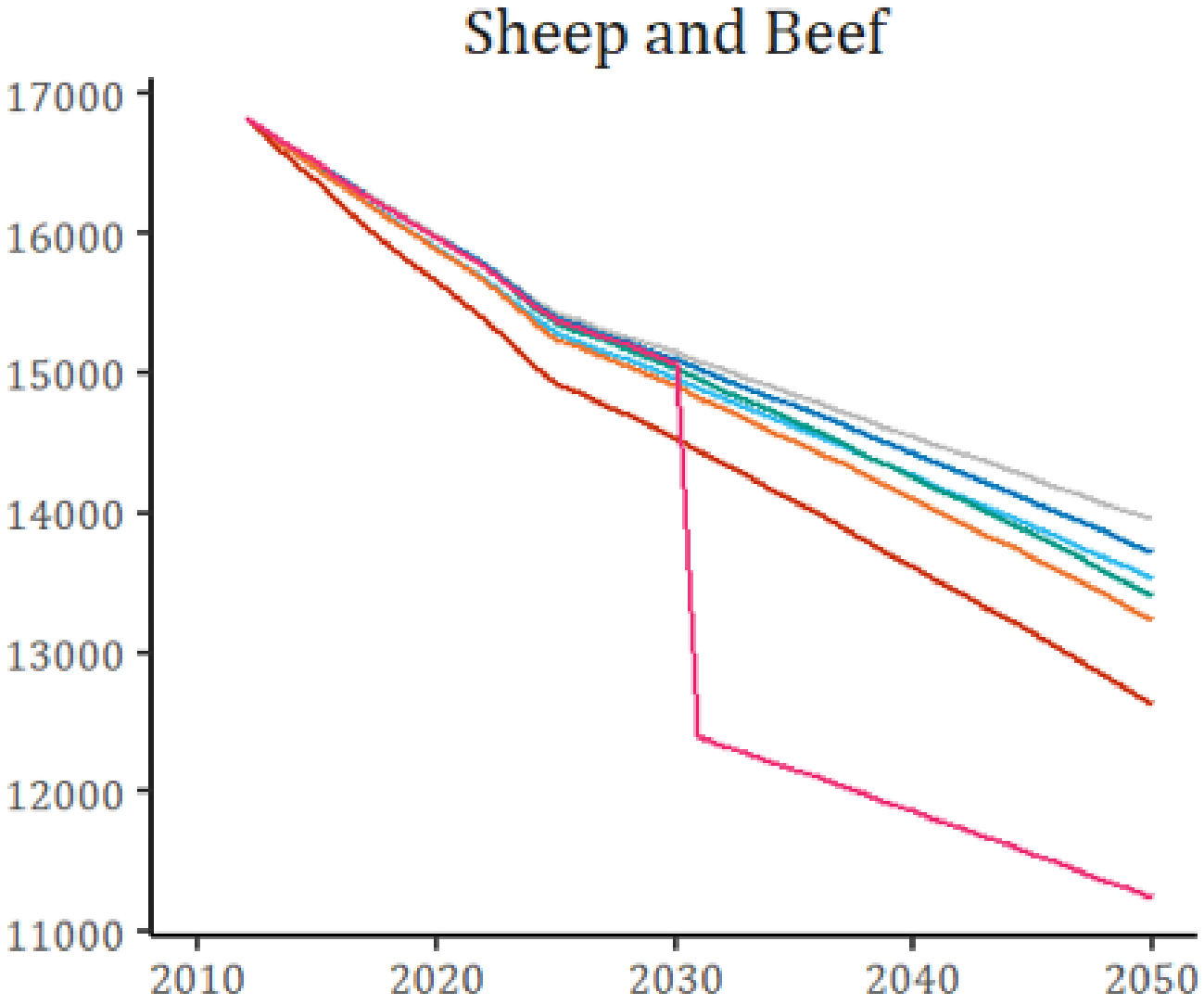
Emission prices indicate intensity of scenario



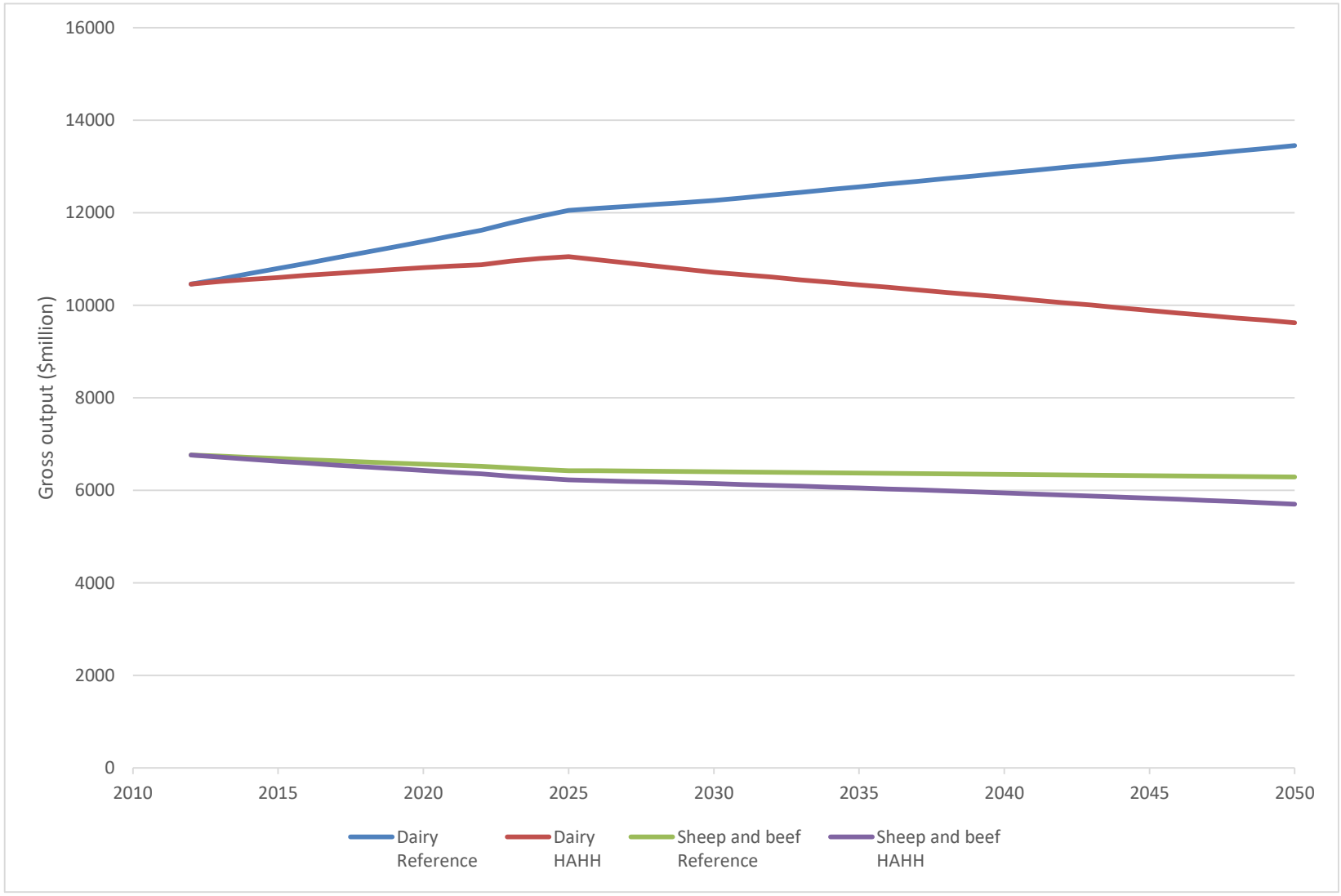
Dairy emissions - kt CO_2-e



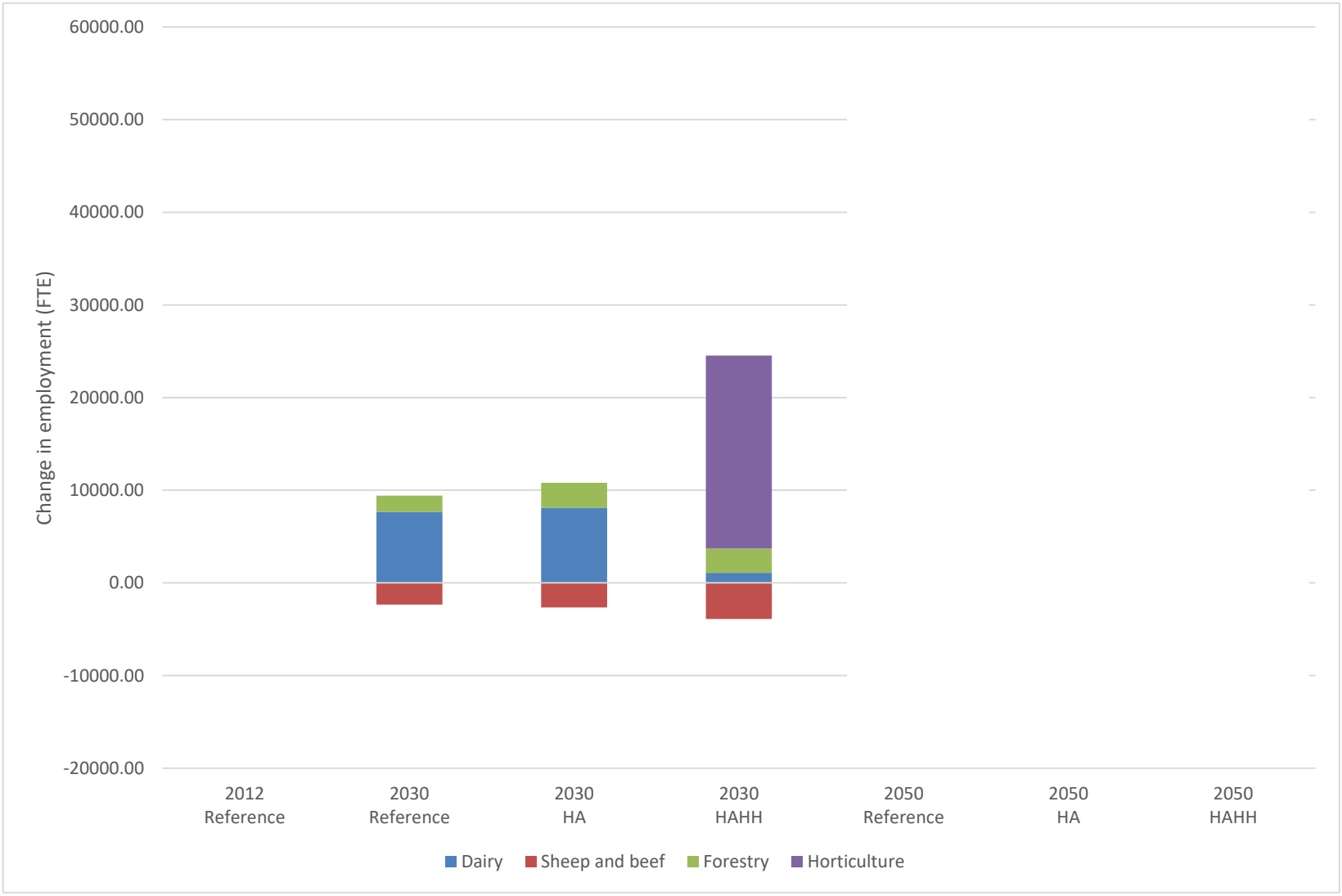
Sheep-beef emissions - kt CO_2-e



Pastoral production changes



Employment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50000.00
40000.00
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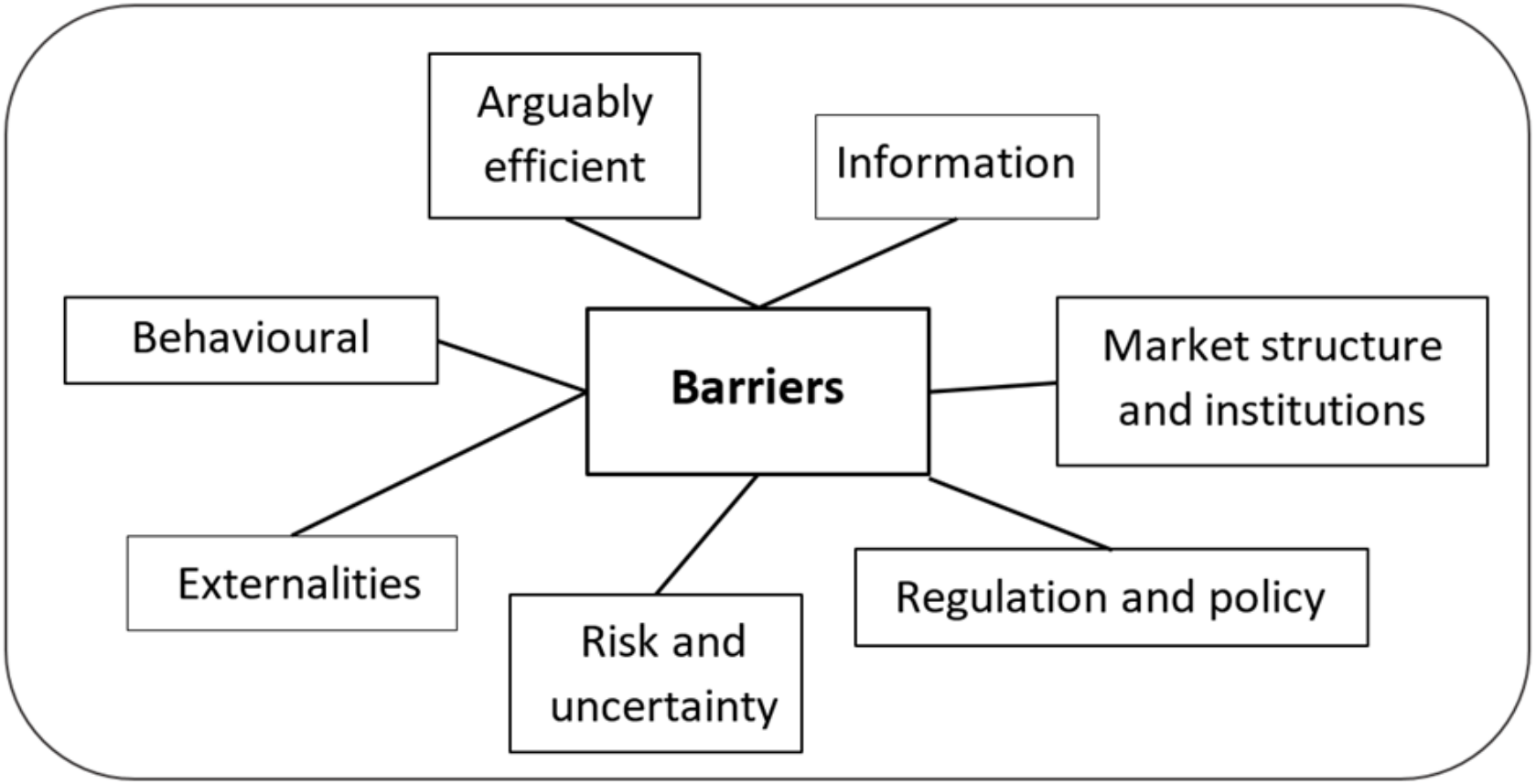
-10000.00
-20000.00
Change in employment (FTE)
2012 Reference
2030 Reference
2030 HA
2030 HAHH
2050 Reference
2050 HA
2050 HAHH
Dairy
Sheep and beef
Forestry
Horticulture

Barriers to land-use change



Key results

1. Mitigation through land-use change is slow – start now
2. Forest expansion is the most price responsive mitigation option (to our knowledge) – extra 58,000 ha per year needed for high mitigation scenario
   - But not a permanent solution
3. A methane vaccine and 1 million ha more horticulture would have similar effects
   - But can we make them happen?
4. Impacts on production and employment don't seem strong and could be good

To meet our targets

Help horticulture to grow

Let forests respond.