Pathways to Achieving our Climate Action Targets
Introducing the Teagasc MACC 2023

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Teagasc MACC 2023

An Updated Analysis of the Greenhouse Gas Abatement Potential of the Irish Agriculture and Land-Use Sectors between 2021 and 2030

Gary Lanigan[1], Kevin Black[2], Trevor Donnellan[1], Paul Crosson[1], Ciara Beausang[1], Kevin Hanrahan[1], Cathal Buckley[1], Ben Lahart[1], Jonathan Herron[1], John Redmond[3], Laurence Shalloo[1], Dominika Krol[1], Patrick Forrestal[1], Niall Farrelly[1], Donal O'Brien[1], J.J. Lenehan[1], Michael Hennessy[1], Michael O'Donovan[1], David Wall[1], Lilian O'Sullivan[1], Tom O'Dwyer[1], Mike Dineen[1], Sinead Waters[1], Nuala NiFlahartha[1], Pat Murphy[1], John Spink[1], Pat Dillon[1], John Upton[1], Karl Richards[1]

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What is a MACC & why do we need a one?

- A MACC sets out, in a visual way, the set of mitigation options

- It ranks them from least to most expensive – easy to see how much mitigation each option will deliver

- Last MACC in 2018, new science since, and policy has changed

- Separate MACC for Agriculture, and also for the LULUCF (Land-Use, Land-use change and Forestry) and Bioenergy sectors

Key Considerations

- ## Agriculture MACC(s)
  - Three Activity Scenarios – S1 (used by EPA), S2 & S3 used for agriculture
  - Two Mitigation Uptake Pathways – Pathway 1 and Pathway 2
  - Different speed of uptake for different measures
  - Separated out efficiency measures - reduce C footprint but not absolute emissions
  - Animal Health, Genetics and Extended Grazing also are enablers for other measures
- ## LULUCF and Energy
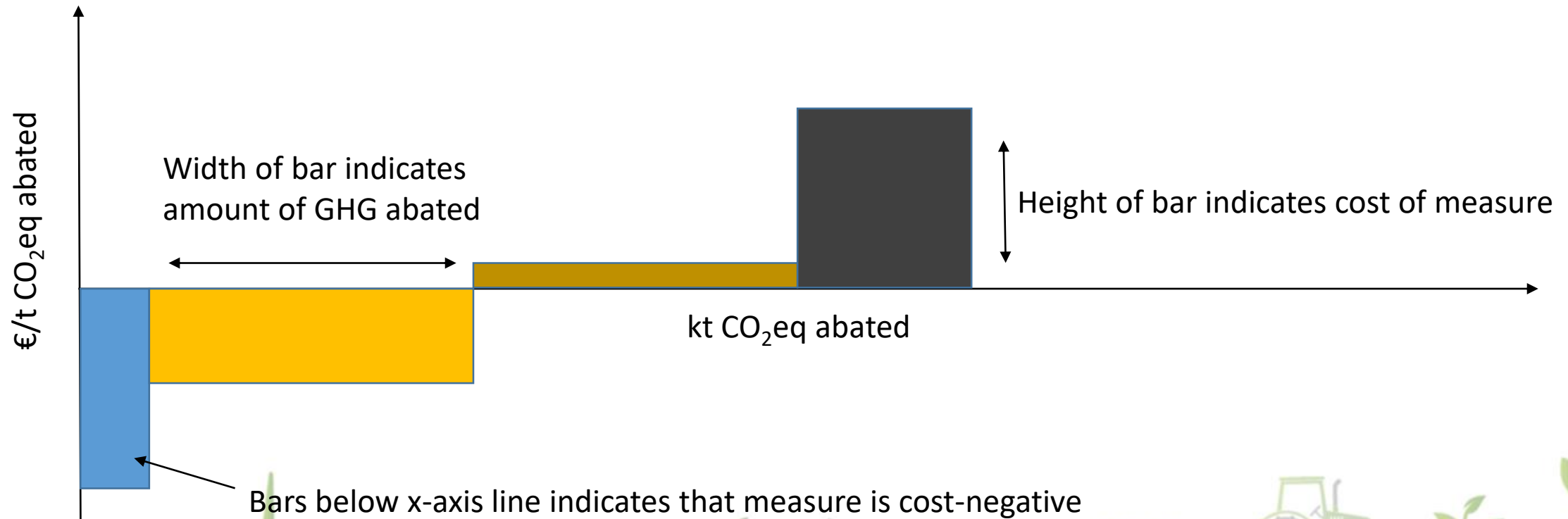 - One Scenario for each

Agricultural Activity Scenarios in 2030

2030 Projected Activity Data and Emissions

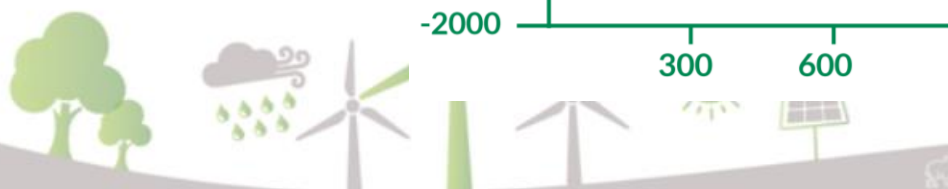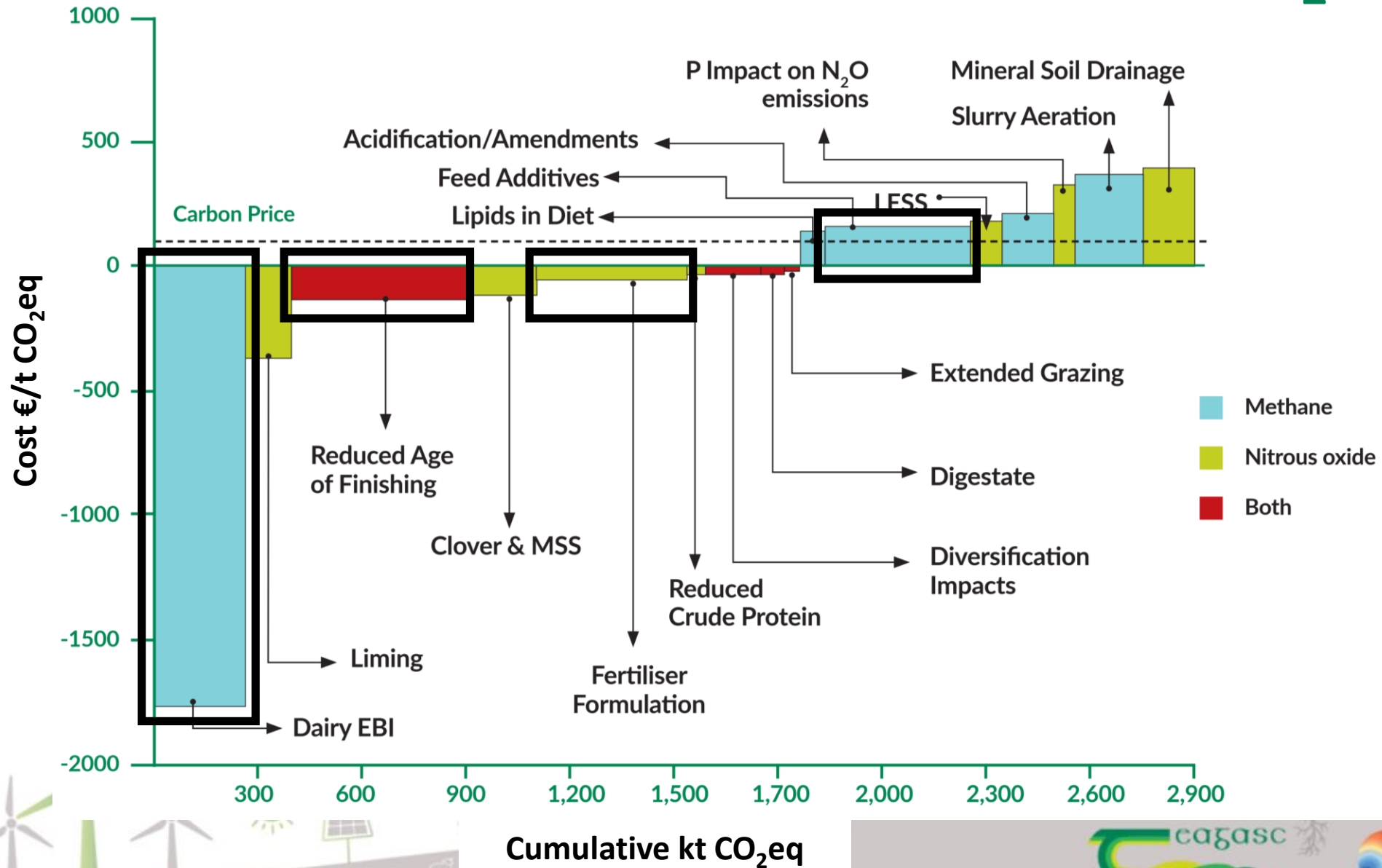|	2022 '000 head	Scenario 1 '000 head	Scenario 2 '000 head	Scenario 3 '000 head
Total Cattle	7,132	6,785	6,541	7,015
Dairy Cows	1,568	1,692	1,627	1,756
Suckler Cows	887	632	504	748
Total Sheep	5,223	4,656	4,664	4,649
Total Pigs	1,676	1,629	1,629	1,630
Total Poultry	19,765	20,911	20,912	20,910
Total Mineral N Fertiliser (tonnes N)	343,200	399,156	369,806	420,989
Total GHG emissions (Mt CO$_2$eq)		21.9	21.1	22.8

Animal Inventories align with the activity level used in the EPA Agriculture GHG inventory – see Ireland's Informative Inventory Report 2023 (EPA, 2023)
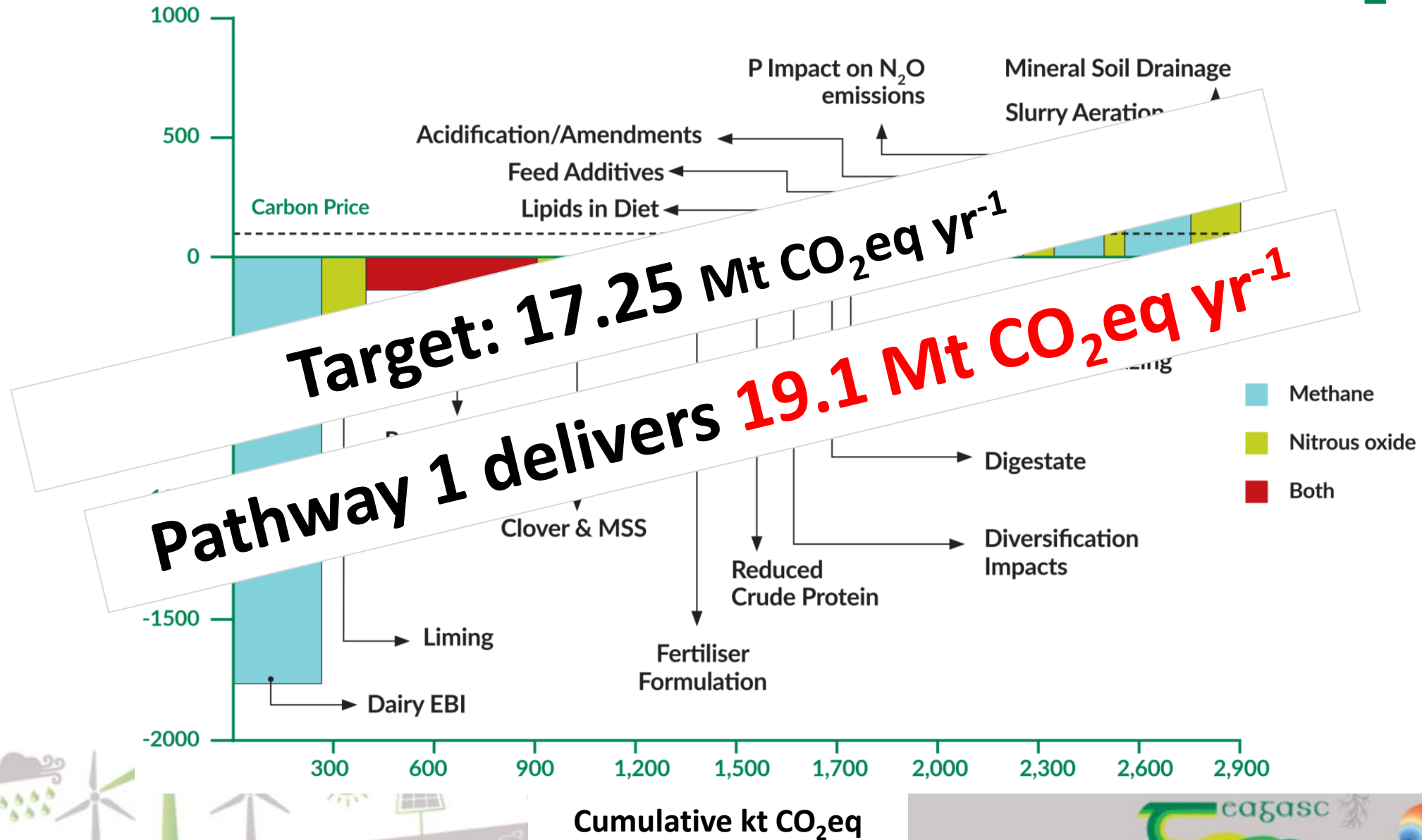
How to Read a MACC

€/t CO$_2$eq abated

Width of bar indicates amount of GHG abated

Height of bar indicates cost of measure

kt CO$_2$eq abated

Bars below x-axis line indicates that measure is cost-negative

Agriculture MACC – Pathway 1 = 2820 kt CO_2eq/yr

Agriculture MACC – Pathway 1 = 2820 kt CO$_2$eq/yr

Target: 17.25 Mt CO$_2$eq yr^{-1}

Pathway 1 delivers 19.1 Mt CO$_2$eq yr^{-1}

Cumulative kt CO$_2$eq

Agriculture MACC – Pathway 2 = 4,858 kt CO_2eq/yr

Target: 17.25 Mt CO_2eq/yr

Pathway 2 delivers 17.0 Mt CO_2eq/yr

Legend:
- Methane
- Nitrous oxide
- Both

Labels on chart: P Impact on N_2O emissions, Slurry aeration, Acidification/Amendments, Mineral soil drainage, Carbon price, Feed Additive, Reduced crude protein, Fertiliser formulation, Clover & MSS, Liming, Dairy EBI

Y-axis: /t CO_2eq (500, 0, -1,500, -2,000)

X-axis: Cumulative kt CO_2eq (500, 1,000, 1,500, 2,000, 2,500, 2,900, 3,400, 3,900, 4,600, 4,900)

Can agriculture meet its targets?

|		Emissions in 2030 after mitigation Mt CO_2eq/yr	Carbon Budget Cumulative Emissions 2030 Mt CO_2eq	Cumulative Emissions Reductions 2021-2030 Mt CO_2eq
Carbon Budget Targets		**17.25**	**202.0**	
Scenario 1	Pathway 1	19.10	206.8	13.1
Scenario 2	Pathway 1	18.40	203.6	12.7
Scenario 3	Pathway 1	19.70	210.2	13.5
Scenario 1	Pathway 2	17.00	198.9	21,1
Scenario 2	Pathway 2	16.40	196.1	20.3
Scenario 3	Pathway 2	17.70	202.2	21.7

The 2018 baseline used for agriculture is 23 *Mt CO_2eq/yr*

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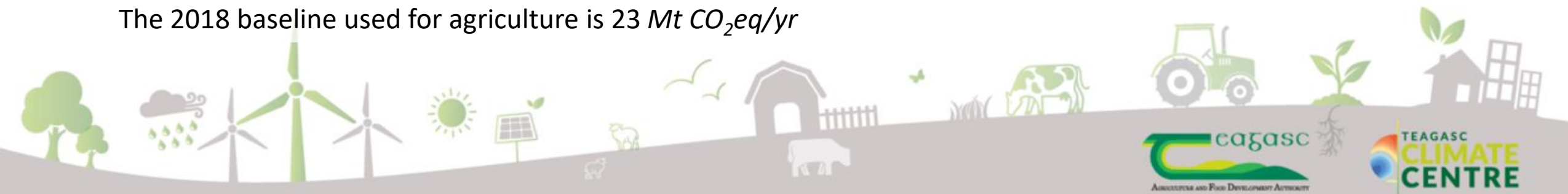
# Uptake Rates of Measures – 80% of Total Mitigation

Measure	Pathway 2	Description of mitigation measure
N-reducing measures (liming, legumes, LESS)	30% (285, 757 tonnes N by 2030)	Reduction in total N
Fertiliser Formulation (Protected Urea, low-N compounds)	100% 95% 65%	Straight urea to protected urea CAN to protected urea Nitrate-based to ammonium-based compounds
Reduced Age of Finishing	3 months	Reduction in the age of finishing both suckler and dairy beef
Feed Additives	50% 65%	Feed additive to dairy cows during grazing Feed additive to cattle during housing
Diversification Impacts (Destocking & Use of Digestate)	137,963 LU 3,500,000 m^3	Displacement of animal numbers Volume of digestate
Manure Management	40% dairy 20% other	Slurry aeration or acidification

LULUCF P1 = 2,267 kt CO_2eq/yr by 2030
P2 = 4,110 kt CO_2eq/yr by 2030
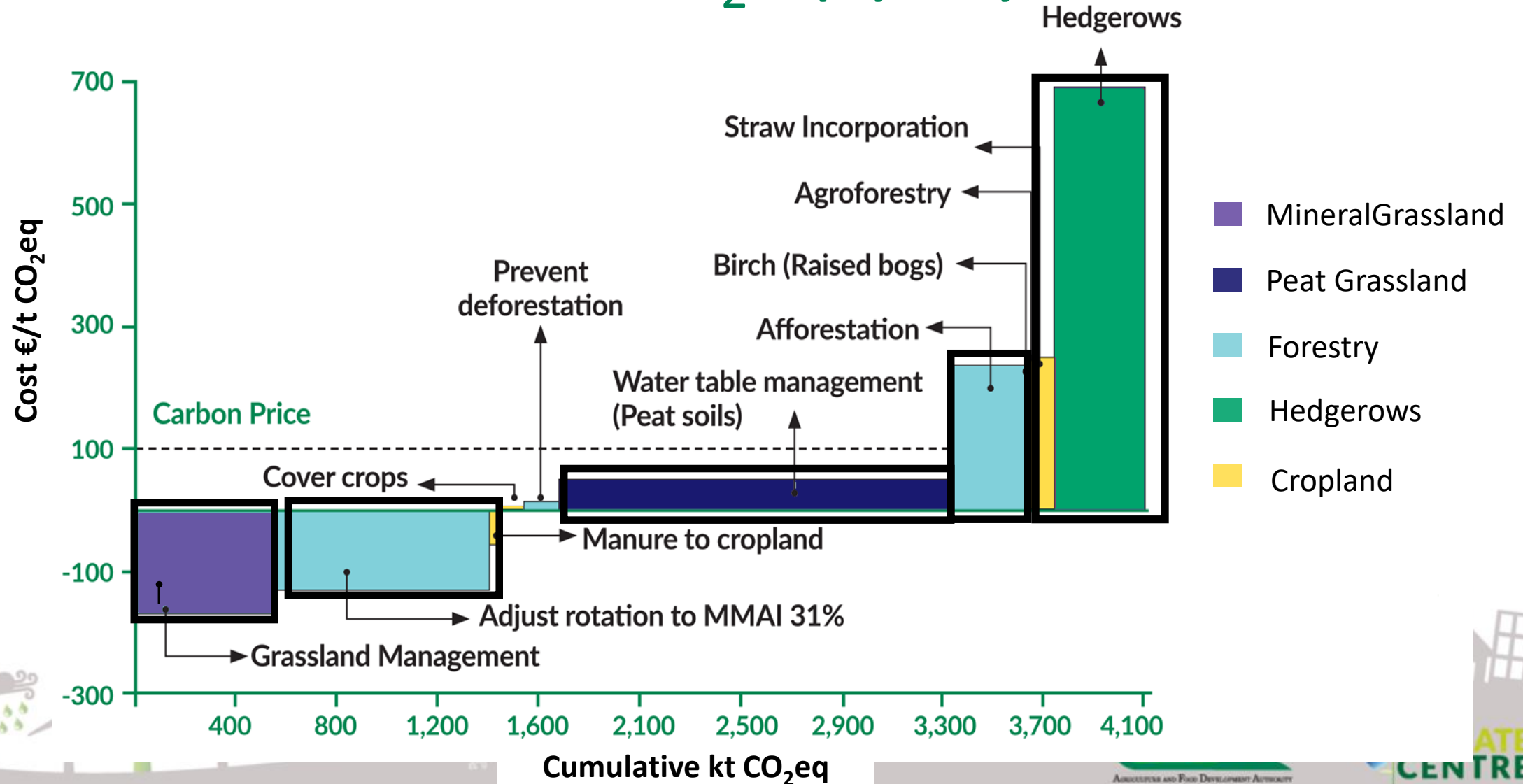
Impact on GHG emissions Profile - LULUCF
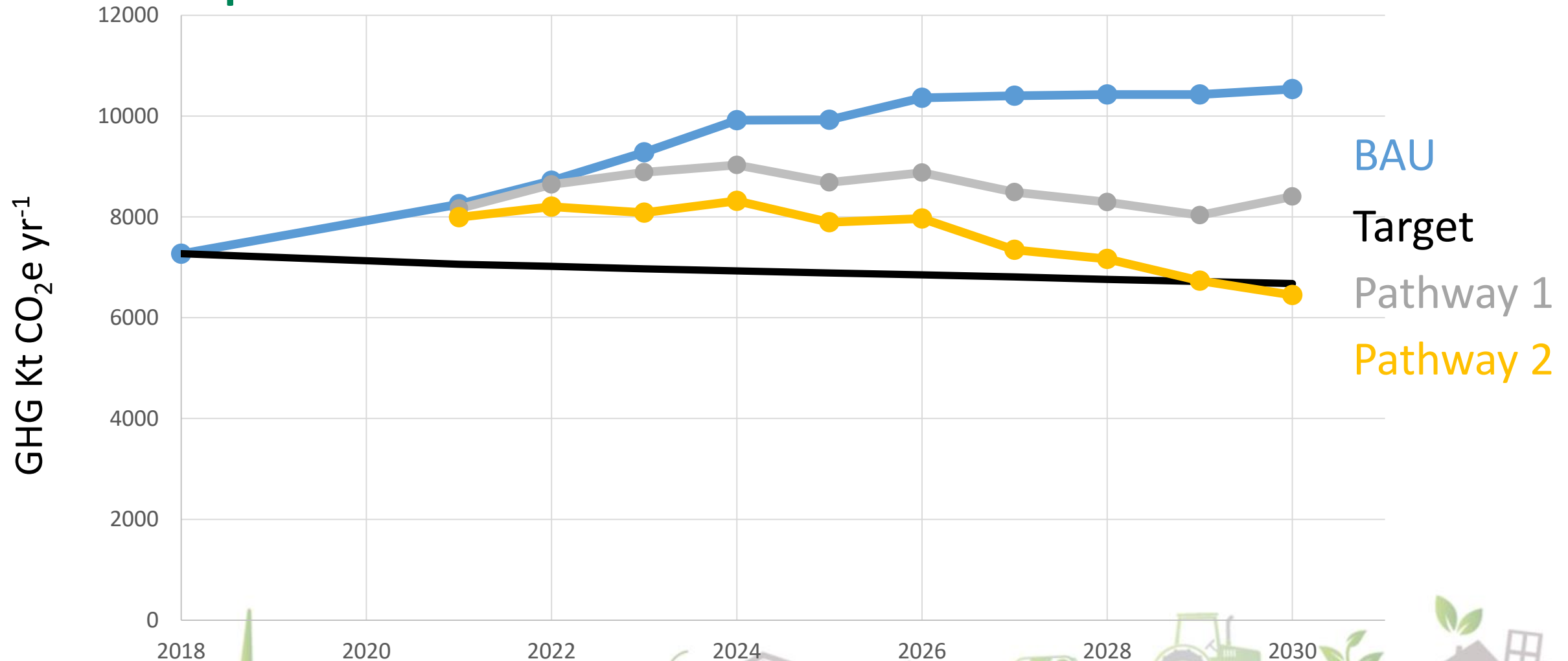
LULUCF

Measure	Pathway 1	Pathway 2	Description of mitigation measure
Forestry	21% MMAI 8000ha by 2030 495 ha p.a. 1 kha	31% MMAI 8000ha by 2030 495 ha p.a. 2 kha	Extend rotation age Afforestation Prevent deforestation Agroforestry
Grassland management	505 kha	750 kha	Optimize soil nutrition and grazing intensity
Water table management	40 kha	80 kha	Raise water table on peat soils
Hedgerows	20,000 km new 50,000 km managed	40,000km new 75,000 km managed	Planting of new hedgerows Allow existing hedges to grow broader and higher

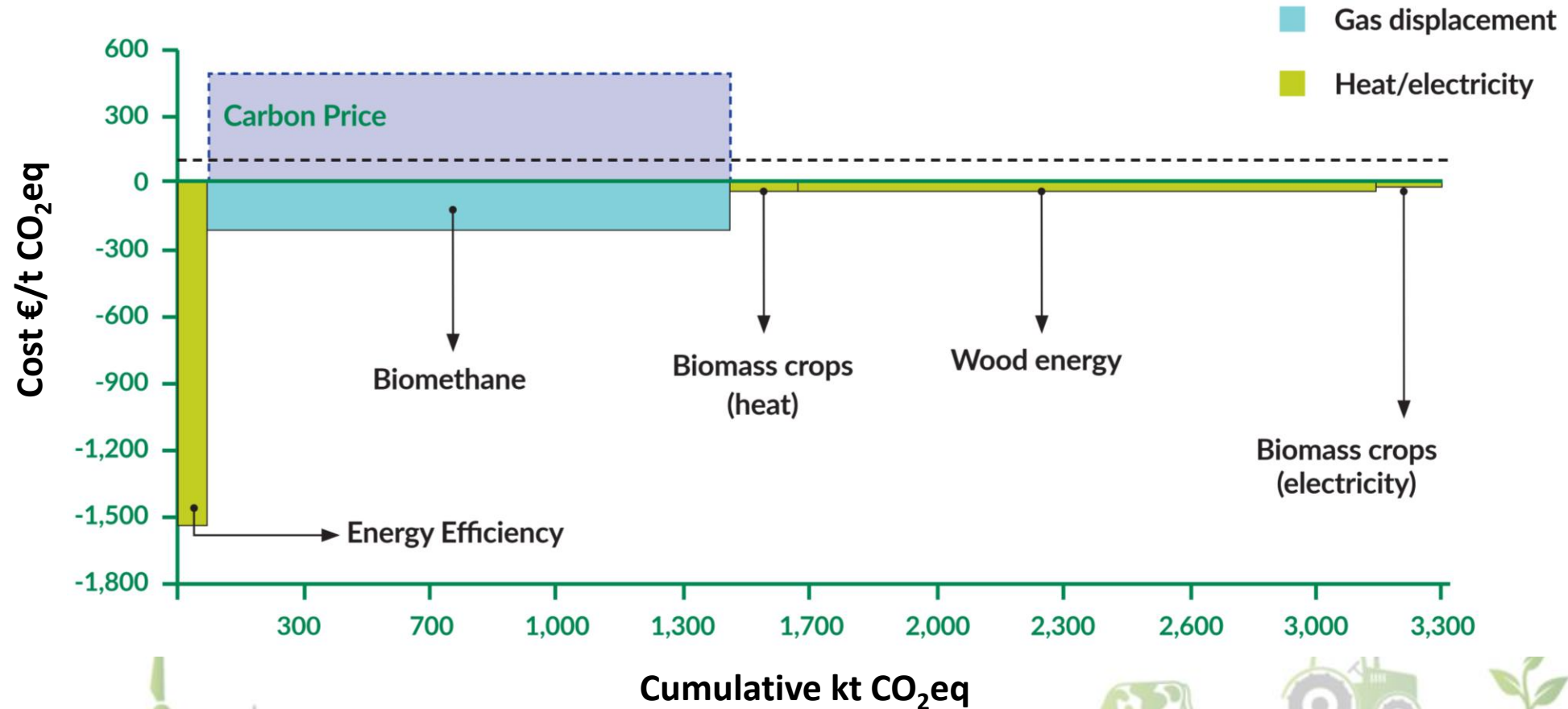# Bioenergy – Pathway 1 = 2,195 kt CO_2eq by 2030
Pathway 2 = 3,446 kt CO_2eq by 2030
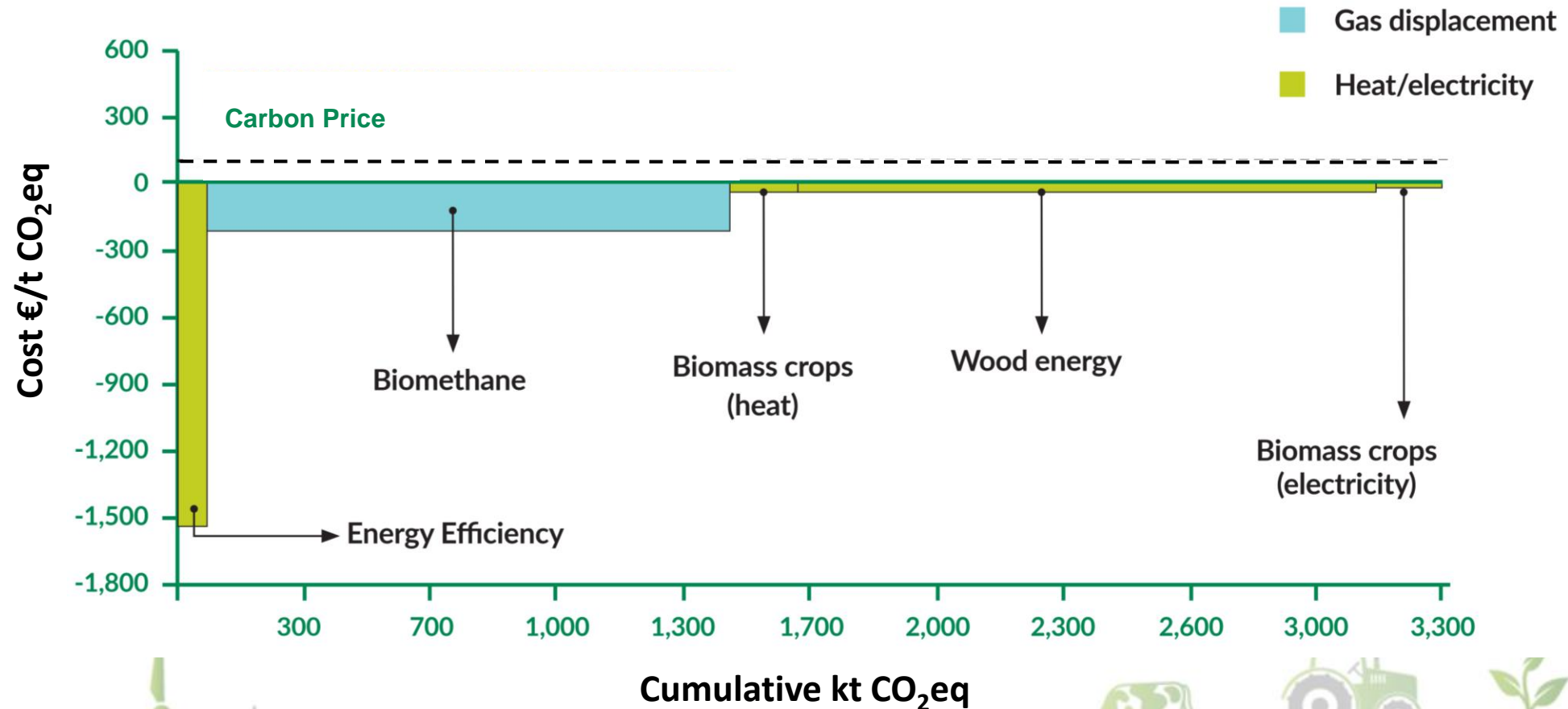
Bioenergy – Pathway 1 = 2,195 kt CO$_2$eq by 2030
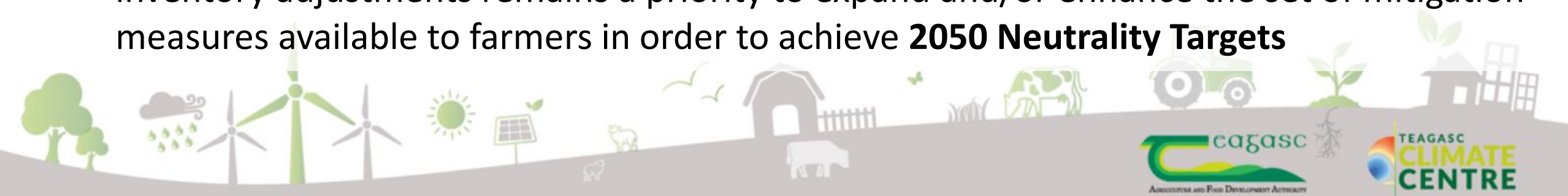## Pathway 2 = 3,446 kt CO$_2$eq by 2030

Bioenergy

Measure	Pathway 1	Pathway 2	Description of mitigation measure
Biomethane	1 TWh	5.7 TWh	Displacement of natural gas with biomethane
Woody/perennial crop biomass	25% dairy 15% other	4.1 TWh 24kha biomass	Displacement of solid fuels

Key Messages

- Agriculture's sectoral targets **can** be achieved using **very high adoption rates** of GHG mitigation measures as outlined in Pathway 2
- **Increased advisory and extension services** will be key to helping guide farmers and land-owners on the path to reduced GHG emissions in 2030 and towards climate neutrality
- The levels of uptake in P2 are beyond what advisory and peer-learning can deliver **alone – clear policy/regulation/incentives will be required**
- **Reductions in LULUCF** emissions of greater than 14% (the EU LULUCF target) will require new science
- **Agriculture and land-use sourced energy substitution** can significantly contribute to energy sector decarbonisation
- **Continuing research and development** of both emission mitigation technologies and inventory adjustments remains a priority to expand and/or enhance the set of mitigation measures available to farmers in order to achieve **2050 Neutrality Targets**

Thank You!