A Marginal Abatement Cost Curve for Irish Agriculture:

Food Harvest 2020 – and beyond

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Contents

1. A Marginal Abatement Cost Curve for Irish Agriculture (Teagasc submission)

2. Credit where credit is due: how can agriculture get credits for abatement options “that don’t count”?

3. Further potential abatement options – subject to research

Context

Previous Submissions

- Submission to previous draft Climate Change Response Bill
- Submission to consultation on Domestic Offsetting
- Briefing Note on Carbon Audits

www.teagasc.ie/publications/submissions.asp

Main points:

- Currently: Irish agriculture = highly C-efficient
- Methane emissions: solutions are limited?
- Challenges in measuring and verifying agricultural emissions?
- Counting carbon does not always equal cutting carbon

Context

What is new in this submission?

- What *can* be achieved in reducing agricultural GHG emissions?
- At what cost / benefit?
- Marginal Abatement Cost Curve (MACC) for Irish Agriculture

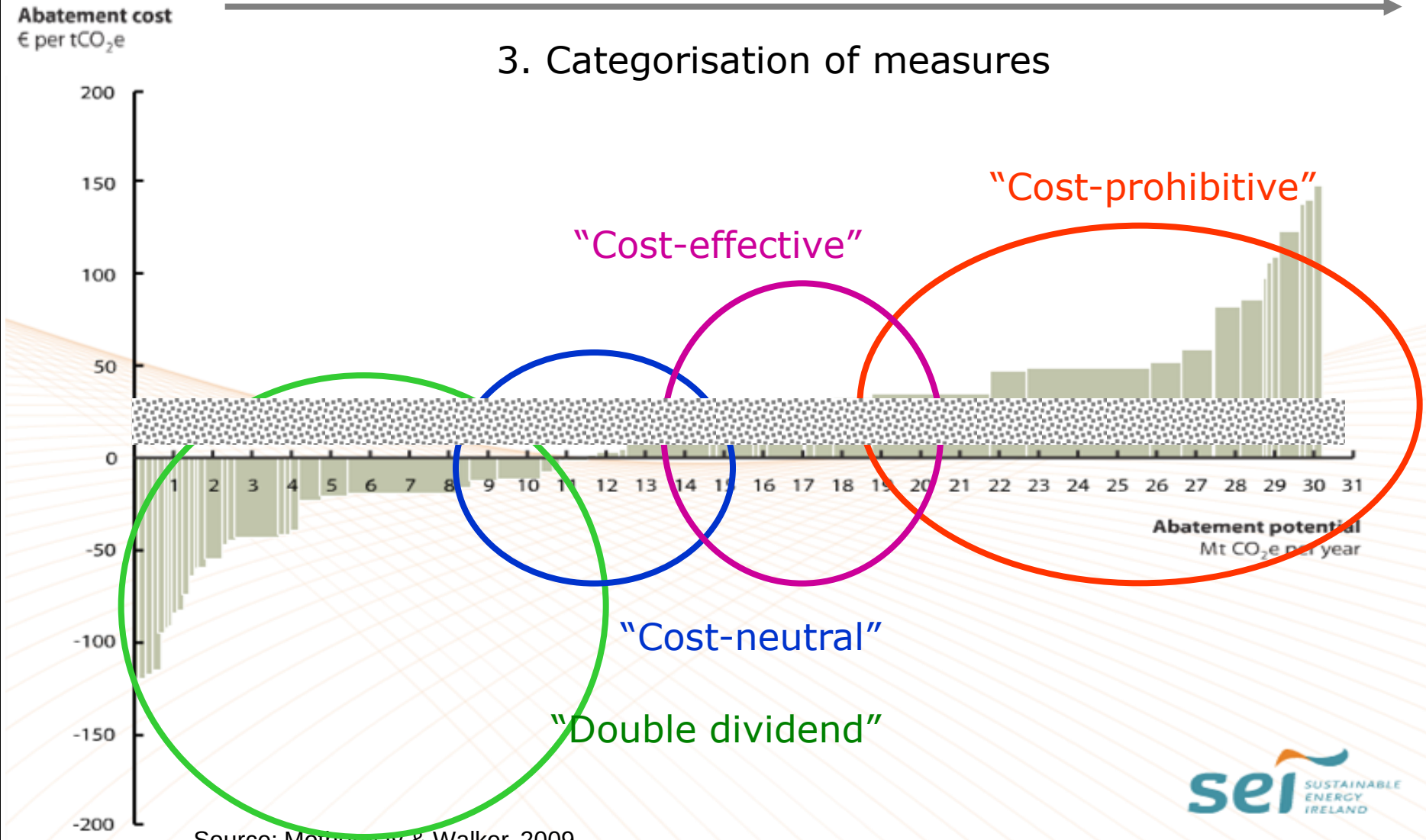
Objectives:

- Collate existing research (10+ years) on abatement options
- Provide independent data as platform for discussion on policy decisions

1. Order of magnitude

2. Ranking of measures

3. Categorisation of measures



Source: Motherway & Walker, 2009
www.seai.ie/Publications/Low_Carbon_Opportunity_Study

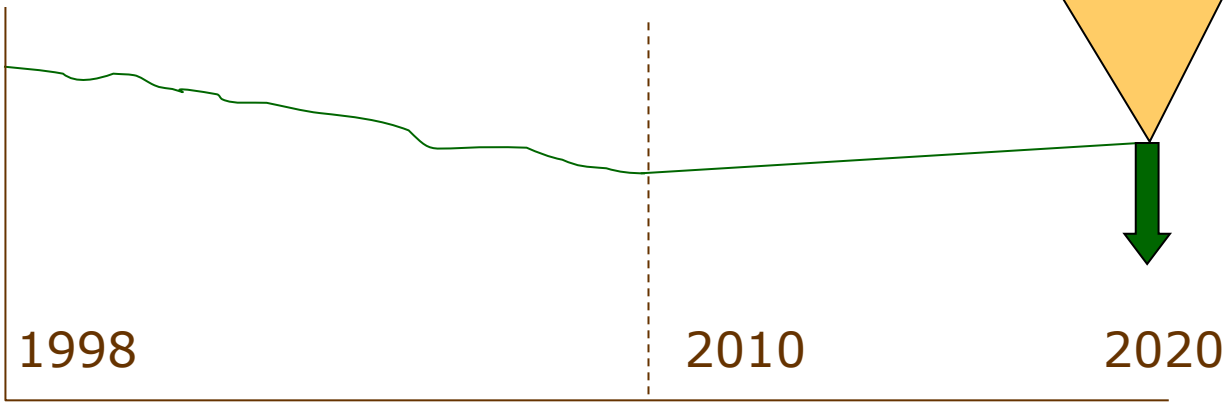
Approach

Starting Point: Food Harvest 2020

- Industry led strategy for growth
- GHG emissions projected to increase by 5-7%
- What are the options to reduce GHG emissions while meeting FH 2020?

Abatement potential =

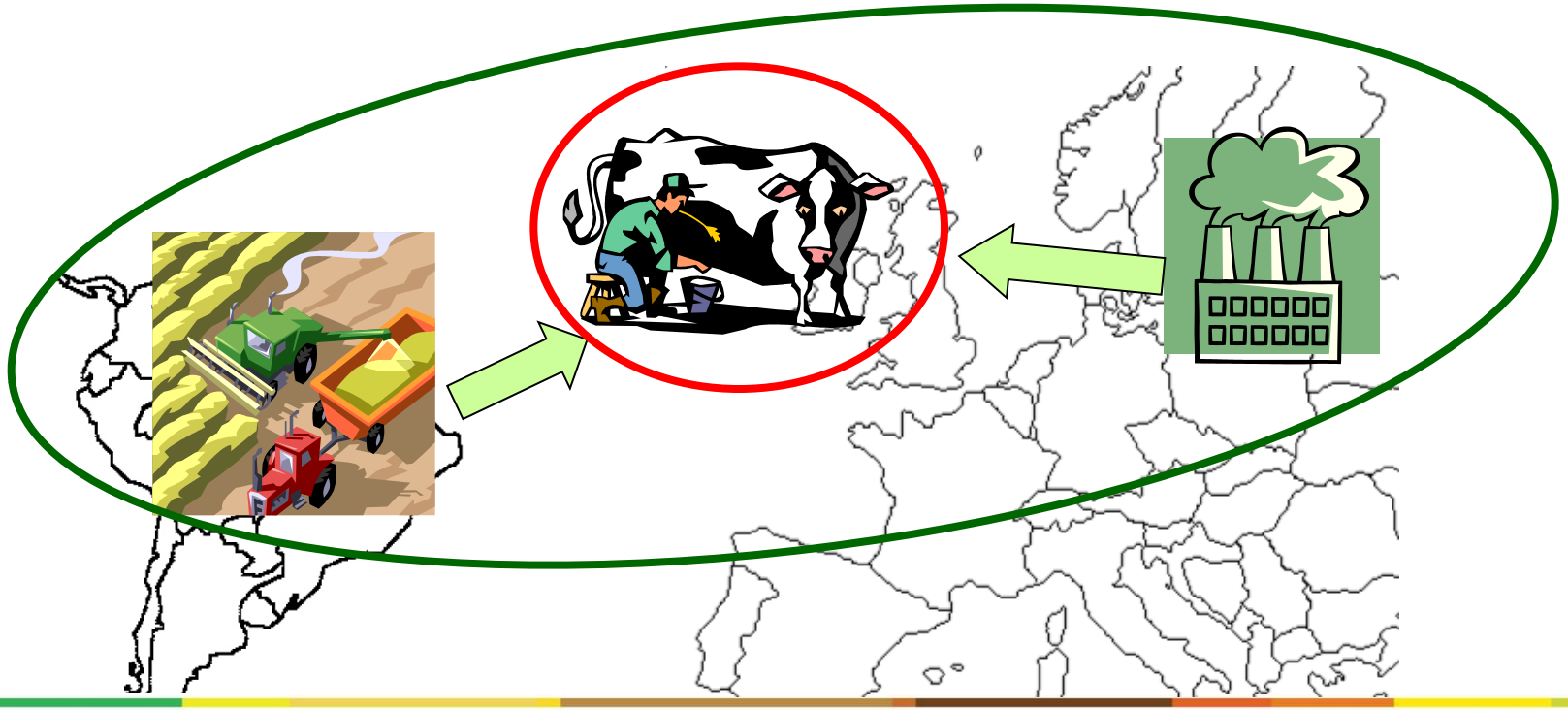
-the total *potential* abatement
-that can be *realistically* achieved
-following *full implementation*
-wherever *biophysically* possible.



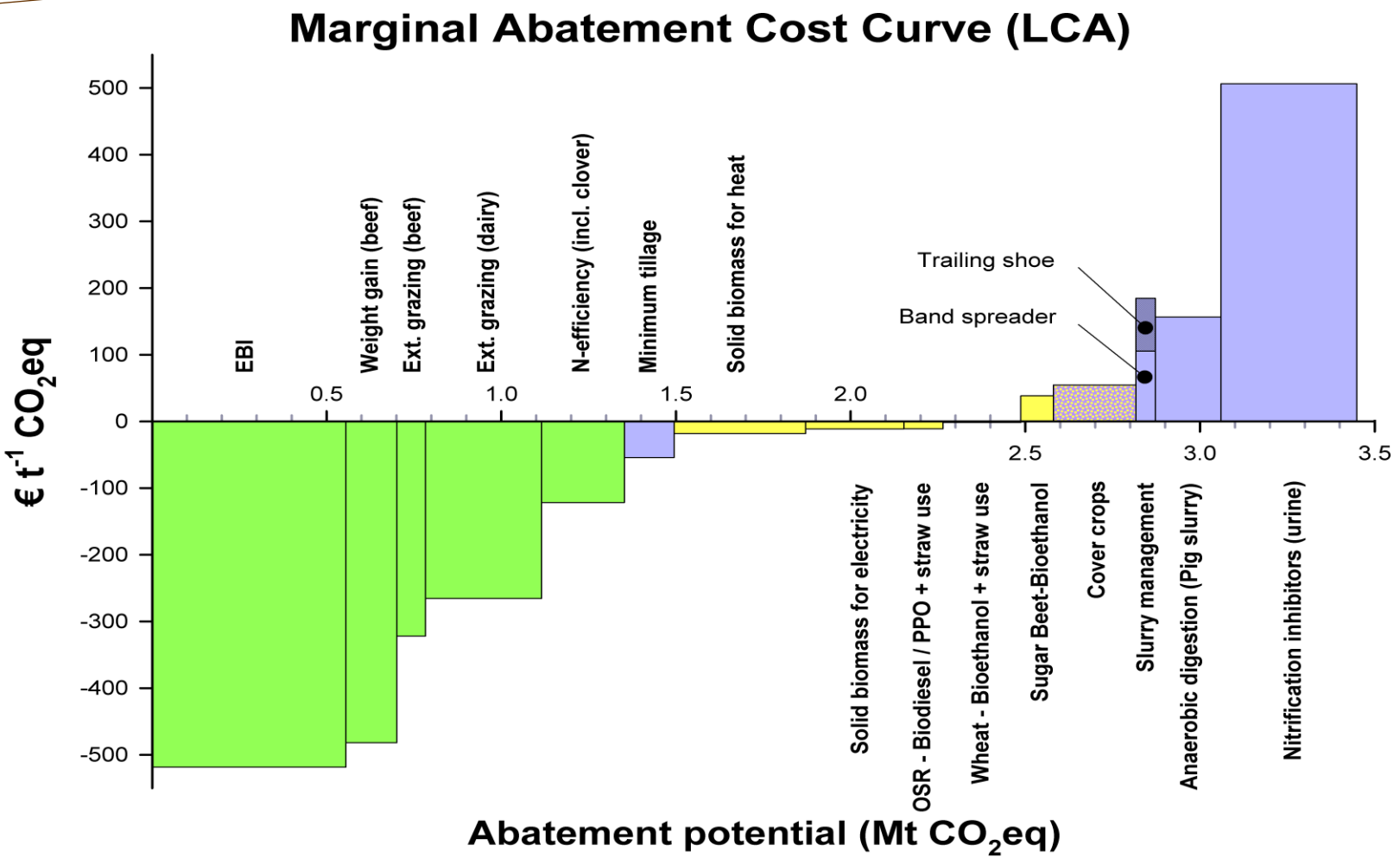
Approach

Scenarios

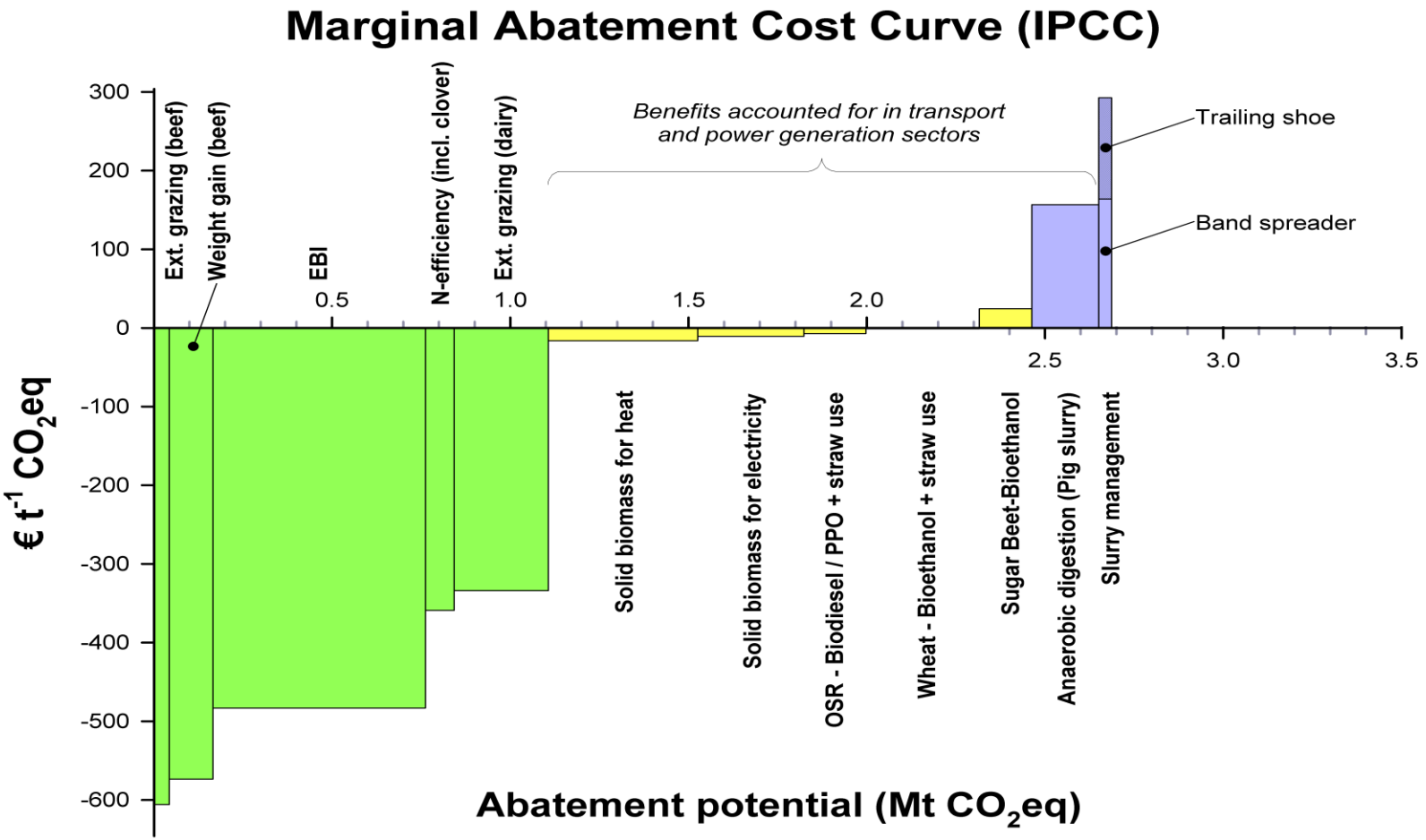
- **Life Cycle Assessment (LCA)**: "real abatement potential"
- **Inventory methodology (IPCC)**: "accountable potential"



Results: LCA


Marginal Abatement Cost Curve (LCA)
€ t-1 CO2eq
500
400
300
200
100
0
-100
-200
-300
-400
-500
0.5
1.0
1.5
2.0
2.5
3.0
3.5
EBI
Weight gain (beef)
Ext. grazing (beef)
Ext. grazing (dairy)
N-efficiency (incl. clover)
Minimum tillage
Solid biomass for heat
Trailing shoe
Band spreader
Solid biomass for electricity
OSR - Biodiesel / PPO + straw use
Wheat - Bioethanol + straw use
Sugar Beet-Bioethanol
Cover crops
Slurry management
Anaerobic digestion (Pig slurry)
Nitrification inhibitors (urine)
Abatement potential (Mt CO2eq)

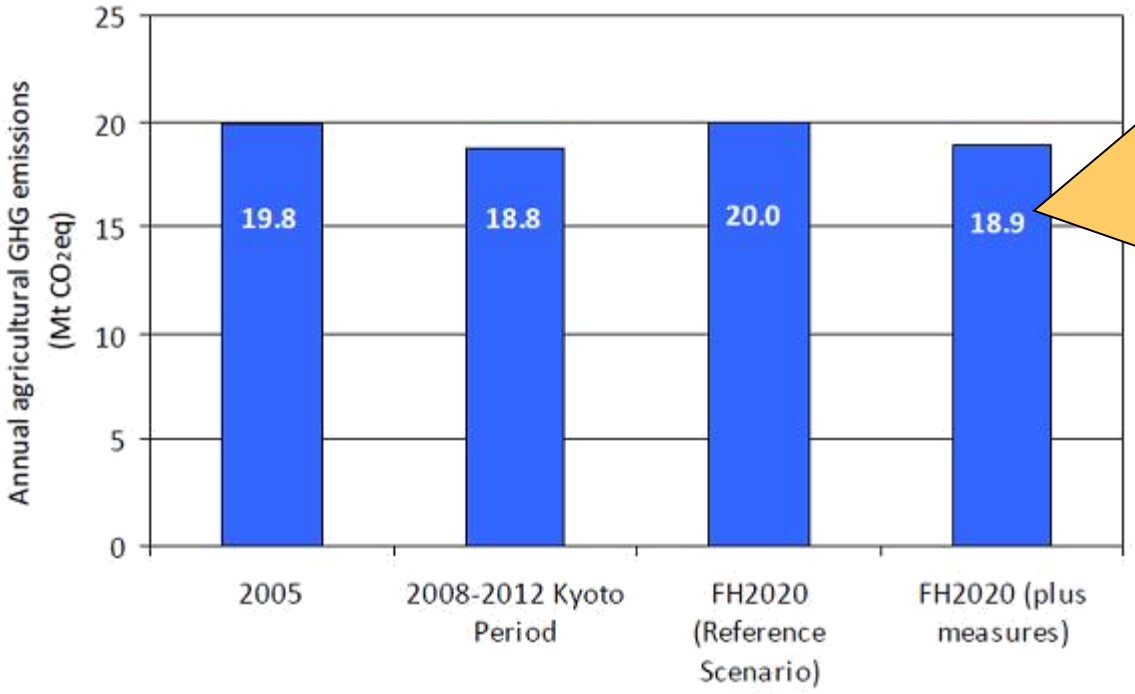
Results: IPCC



Results

Key-messages:

- Total abatement potential (LCA) < €33 per t: *c.* 2.5 Mt
- Accountable for agriculture (IPCC): *c.* 1.1 Mt
- Ranking of measures: efficiency – bioenergy - technology



Compared to:

2005 (EU):	-4.5%
Kyoto period:	+0.5%
FH2020(ref):	-5.5%

Not accounted for in IPCC…

- Some current measures, e.g. nitrification inhibitors
- Forestry
- Biofuel / bio-energy
- Future measures (subject to research)
  - Replace CAN with urea + low-cost nitrification and urease inhibitors
  - Anaerobic digestion of biomass
  - Grassland sequestration
  - Animal disease prevention and control

Role for research + inventory refinement

Forestry

- Significant potential
- Depends on acceleration of planting rates above 8,000ha p.a.
- From 2.3 Mt (16,000 ha) to 5.6 Mt (20,000ha) CO_2eq p.a.
- Relative abatement cost: €26- €43 per t CO_2eq
- Accountancy rules subject to current international negotiations
- If forest sequestration is included in offsetting potential, will targets be adjusted accordingly?



Biofuel / bio-energy

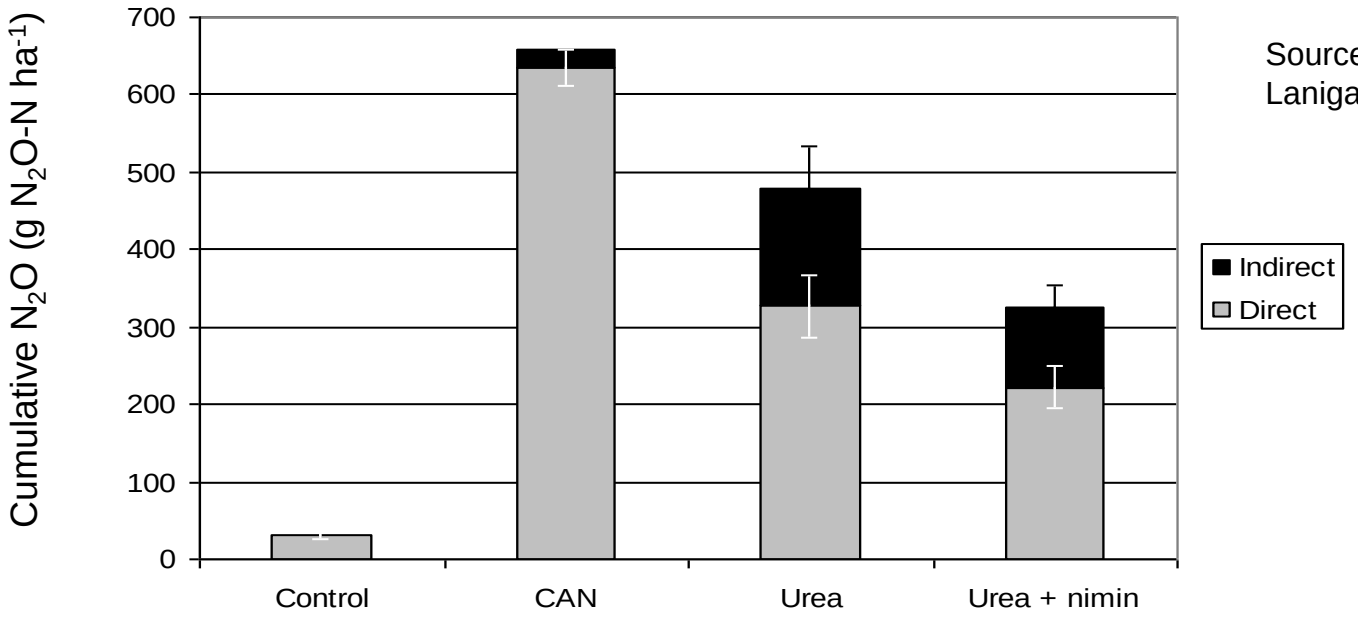
- MACC potential (realistic but ambitious): 1.4 Mt CO_2eq p.a.
- Challenges to meeting this potential:
  - Financially: measures are "only" cost-neutral
  - Abatement: Credits will go to transport / power gen sectors
- How can producers be incentivised? Role for Domestic Offsetting?
- Objective:
  - *Not*: maximising abatement share attributed to agriculture
  - Maximising uptake → meet potential



Future measures (beyond 2020)

Replacing CAN with Urea (+ low-cost nitrification / urease inhibitors)

- Application of CAN → N2O emissions → c. 10% of agri GHG's
- Replacing with Urea reduces N_2O emissions



Source: Maratha, Osborne & Lanigan (unpublished)

Future measures (beyond 2020)

Anaerobic Digestion:

- Displaces fossil fuel imports
- Reduces methane emissions?

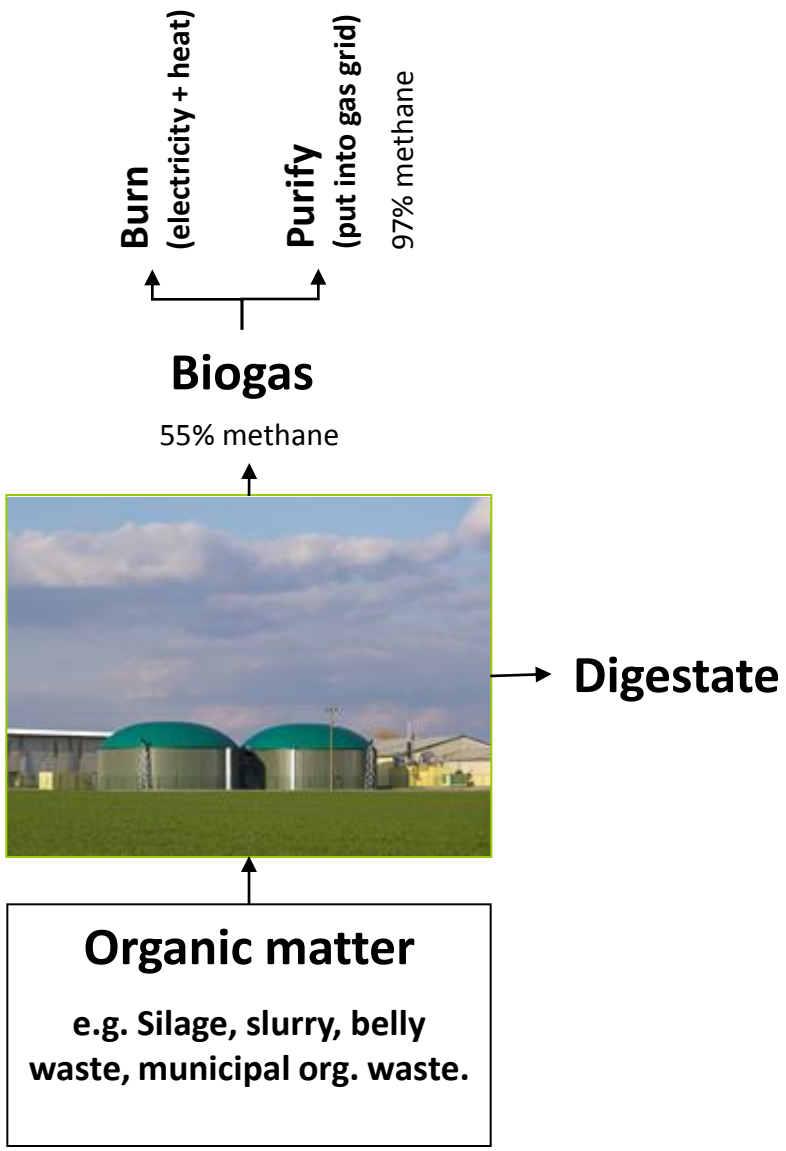
Abatement potential:

- One 40 ha farm:

"a few hundred tons CO_2eq"

Cost-effectiveness:

- ?
- Large capital requirement
- Depends on scale



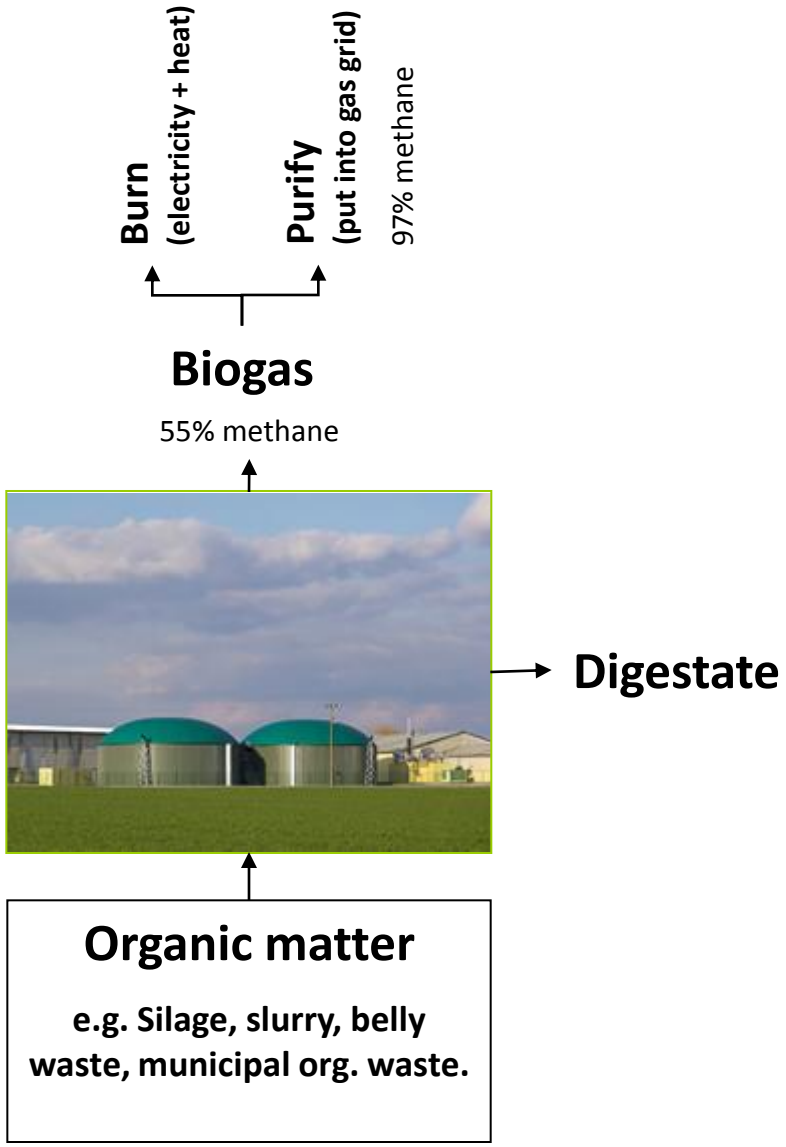
Future measures (beyond 2020)

Constraints:

- Capital investment
- Accessibility of electricity/gas/heat grid outlets
- Optimisation for grass feedstock

Research:

- Teagasc, UCC, QUB, UCD, MTT (F)
- Technology for digester exists
- Optimise technology
- Manipulate feedstock & biogas potential



Future measures (beyond 2020)

Pasture C-sequestration:

- Offsetting of GHG emissions
- Known:
  - grasslands can sequester carbon
- Unknown:
  - How much do they sequester?
  - For how long?
  - Do they sequester more now than in 1990?

Challenges:

- Large inter-annual variation
- Measuring small fluxes against large background

Future measures (beyond 2020)

Animal disease prevention and control

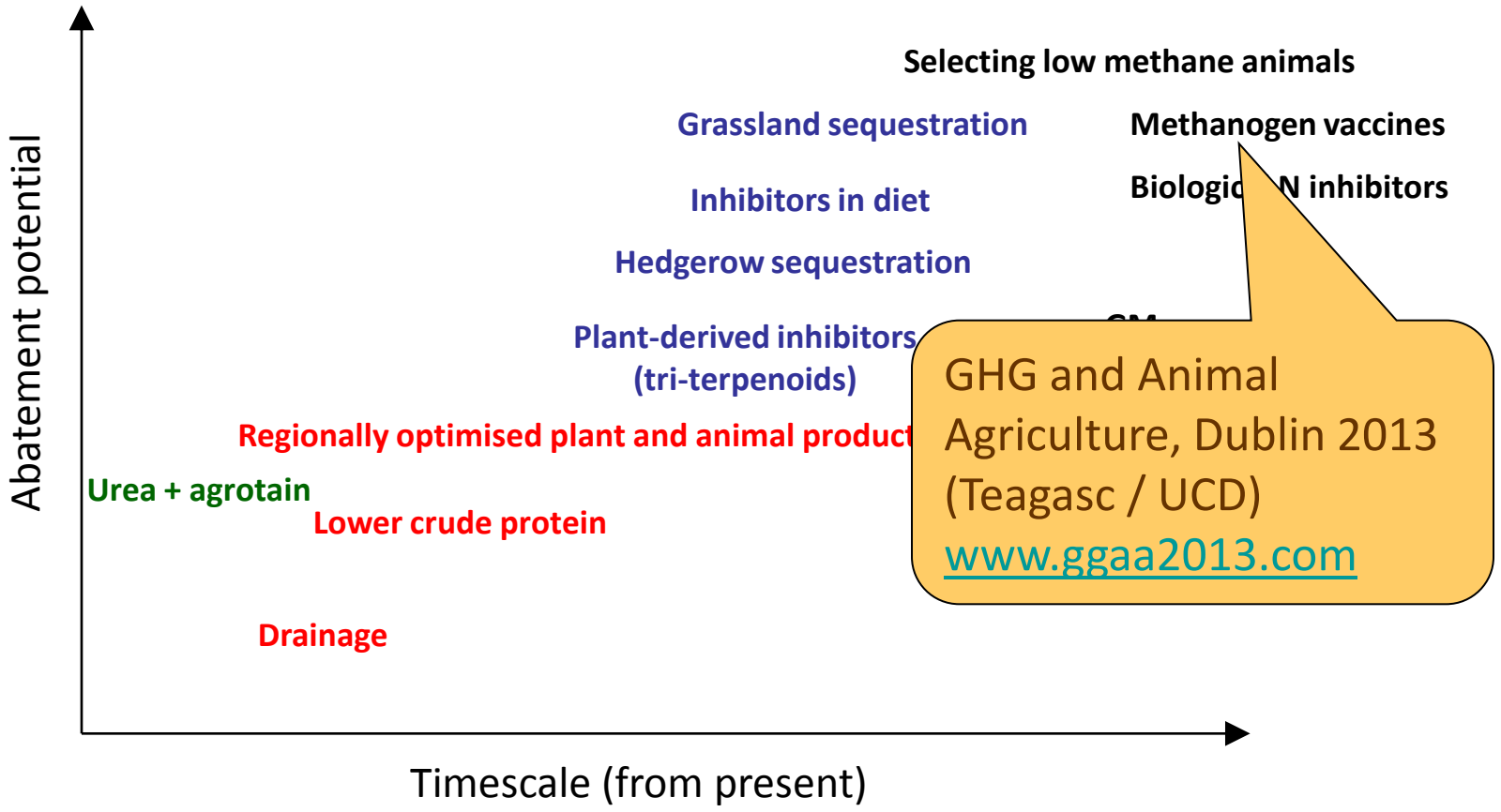
- Improves growth rates and milk production, reduces mortality and culling
- Therefore: lower C-footprint per unit product → fewer animals required to meet FH2020 → reduced CH_4 emissions
- Profitability:
  - BVD costing €120 million annually (Stott et al., 2012)
  - Mastitis costing 2.5 to 3.0c/l (Geary et al., 2012)

Challenge:

- What level of disease control is baseline; what is additional?



Future measures (beyond 2020)



Conclusions

MACC curve

- Total realistic abatement potential 2020: *c.* 2.5 Mt CO_2eq
- Accounted for in inventories: 1.1 Mt CO_2eq
  - = no change from current emissions
  - = -5% compared to 2005
- Costs: efficiency < land use change < technology

Further reductions would require:

- Change in accountancy arrangements (forestry, biofuels)
- Future measures, subject to ongoing research

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