

Mitigation Strategies for lower carbon Dairy and Beef

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Outline

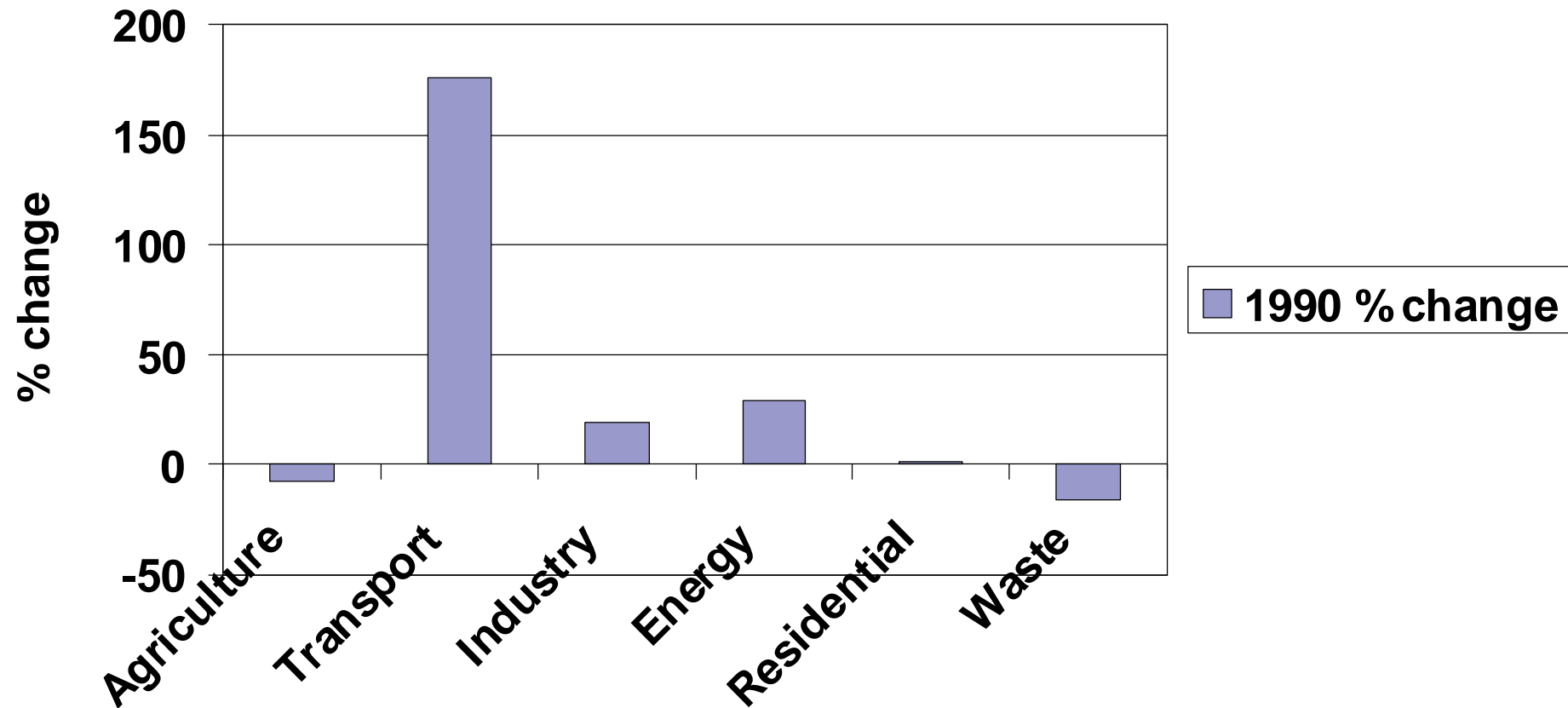
- Revision (Thursday)
- GHG Modeling
- Dairy
 - National versus International emissions
 - Mitigation Strategies
- Beef
 - National versus International emissions
 - Mitigation Strategies
- Considerations and conclusions



Greenhouse Gas Emissions and Livestock

- Globally Livestock account for 18% of GHG emissions (FAO, 2006)
- The contribution of agriculture to national emissions varies substantially between countries
 - 27% Ireland
 - 49% New Zealand
 - 1% Japan
 - 4% UK
 - 12% Australia

Emissions change since 1990-2009



- GHG emissions were 23% higher in 2008 than 1990 (EPA, 2010)



Ireland's GHG emissions

- Enteric fermentation responsible for 50% of Irish Agricultural emissions (EPA, 2009)
- Post Kyoto Ireland non-ETS sector committed to reduce emissions by 20% (Potentially 30%)
- Dairy and Beef Sectors will be required to develop reduction strategies
- Successful mitigation (Global vs National reductions)



GHG modelling

GHG Model

- Emissions quantified using a whole farm model;
 - Whole Farm Model (Moorepark Dairy System Model; Shalloo et al., 2004)
 - GHG model (O'Brien et al., 2010)
- MDSM used to define key parameters for GHG model
- Biological and Physical data for MDSM taken from NFS, CSO and MPK surveys
- GHG model integrates MDSM parameters with specific emission/removal factors



IPCC - Methodology

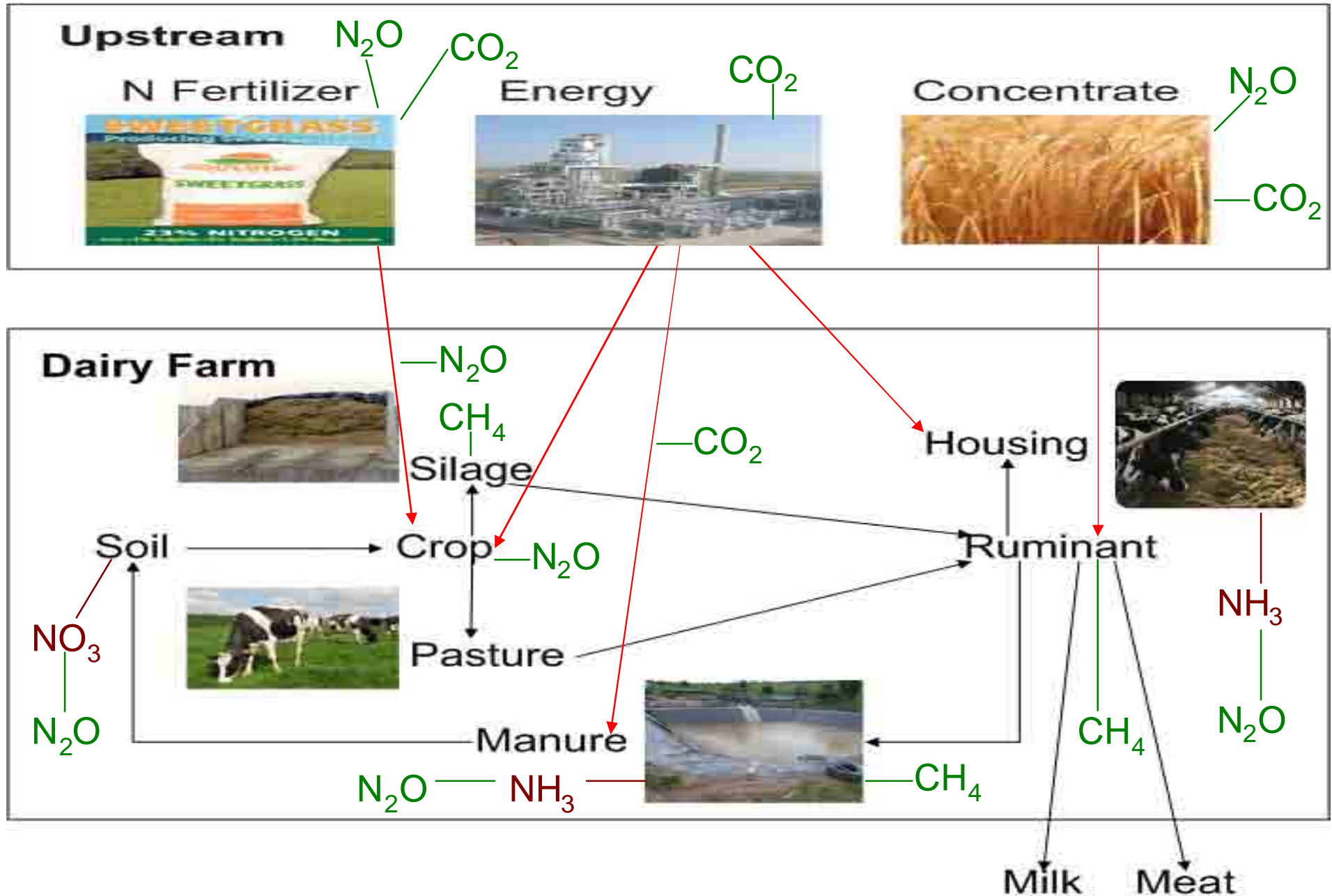
- Intergovernmental Panel on Climate Change (IPCC) Method
 - National approach used to assess emission targets
 - Estimates on-farm emissions excluding energy
 - Not all emissions included
 - Not full picture



Life Cycle Analysis

- Life Cycle Analysis (LCA)
 - Systems approach
 - Calculates all on-farm emissions and pre-chain emissions e.g. fertilizer production
 - Emissions allocated between milk and meat
 - Emissions quantified per unit of product
 - All emissions included

IPCC versus LCA





Dairy emissions

National Data

	National 2008*
Milk yield (kg/cow)	4,661
Protein %	3.33
Fat %	3.82
MS kg/cow	334
S.R. cows/Ha	1.9
Replacement rate %	25
Herbage utilisation kg/Ha	6,630

* (NFS, CSO,MPK surveys)

National Emissions

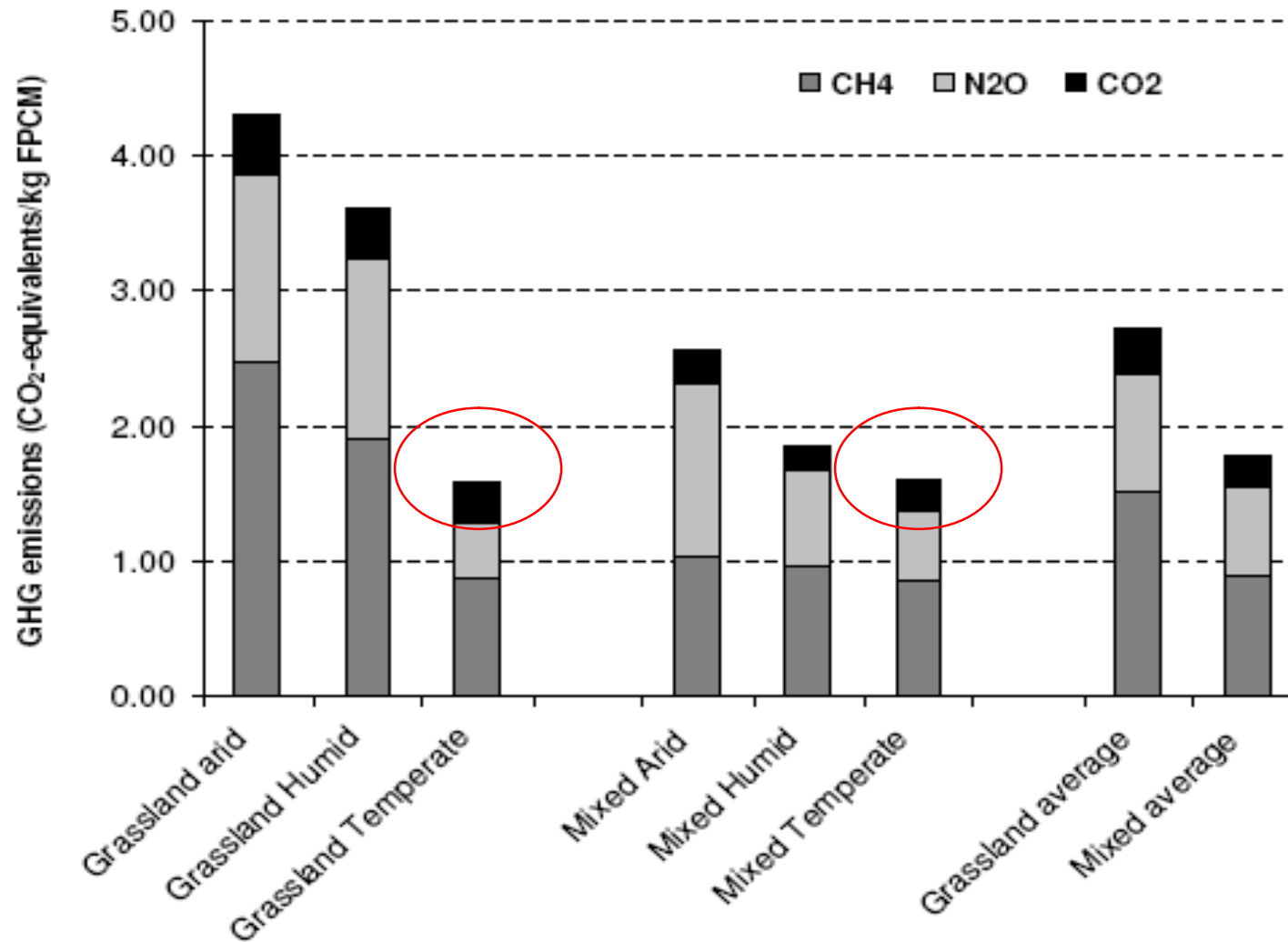
GHG measure	Method	2008
kg CO ₂ e/kg milk sold	IPCC	1.13
	LCA*	1.15
kg CO ₂ e/kg MS sold	IPCC	15.72
	LCA*	16.06
t CO ₂ /ha	IPCC	7.49
	LCA	9.00

*15% Emissions allocated meat

LCA GHG emissions

Reference	Country	kg CO₂e/kg milk
Capper et al. (2009)	USA	1.35
Thomassen et al. (2008)	Holland	1.5-1.6
Cederberg et al. (2009)	Sweden	1.02
Basset-Mens et al. (2009)	New Zealand	0.93 (potential 0.65)
Moorepark (2010)	Ireland	1.15

LCA GHG emissions IDF-FAO



Dairy mitigation strategies





- Mitigation strategies that increase profit and reduce emissions

- Win-Win

- Increasing EBI
- Grazing season length
- Grassland management
- Nutrient management
- Clover

Dairy Mitigation

- Extend grazing season
 - Emission factors
 - Grazing vs Silage
 - Increased productivity
 - Milk production
 - Milk solids concentration
 - Reduce quantity of slurry
 - Stored
 - Spread



Grazing Season

	Kly	MPK
Grazing Season	149	250
Milk Solids yield kg/cow	423	465

Grazing Season

	Kly	MPK
Grazing Season	149	250
Milk yield kg/MS/cow	423	465
Grazed grass kg DM/cow	2,137	3,700
Grass silage kg DM/cow	2,376	1,102
Concentrate kg DM/cow	764	350
Nitrogen kg/Ha	238	300

Grazing Season

	Kly	MPK
CH4 kgCO2e/kgMS	11.22	8.90
N2O kgCO2e/kgMS	4.25	3.79
CO2 kgCO2e/kgMS	3.98	3.79

1 Day = 0.17% reduction in emissions using LCA

1 Day = 0.14% reduction in emissions using IPCC

Dairy Mitigation Strategies

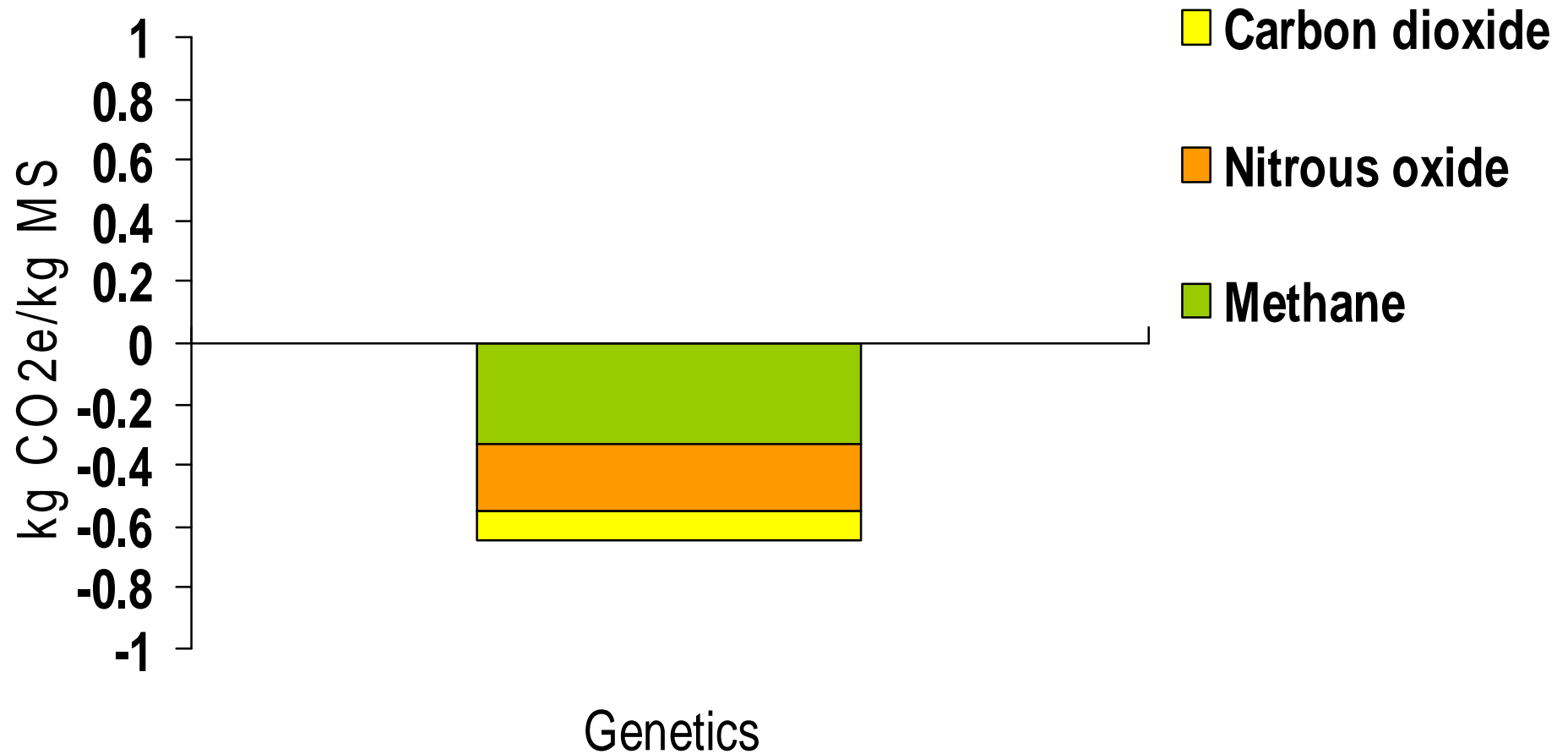
■ Increase herd EBI

- Improve fertility -1% reduction in replacement rate
- Increase milk solids - 0.1% increase in fat and protein
- Earlier calving date - MCD Feb 20th vs Mar 15th
- Increased milk yield – 100l/cow



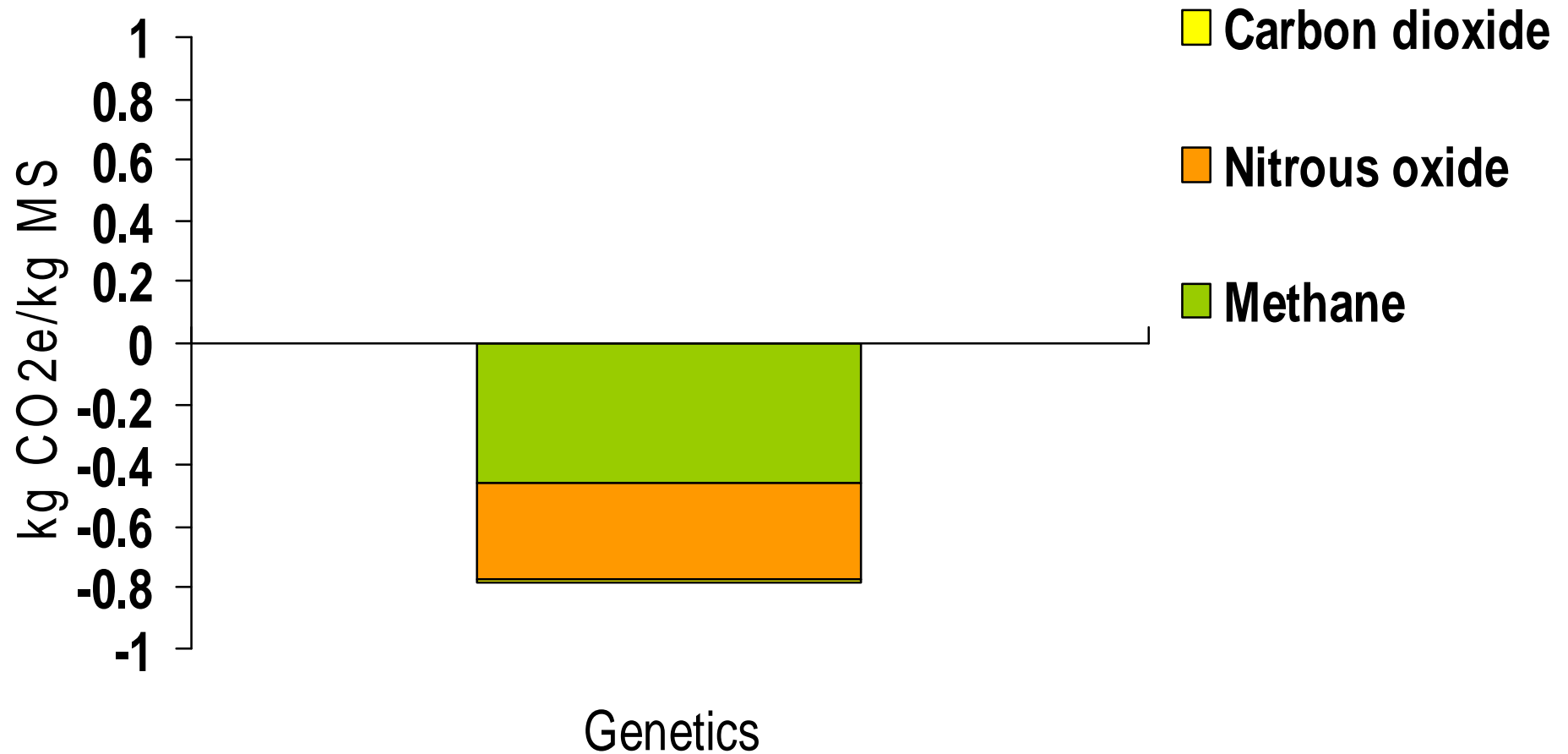
Genetics

LCA Dairy GHG emissions reductions



Genetics

IPCC Dairy GHG emissions reductions



National 2020

	National *2008	National 2020
Milk yield (kg/cow)	4,715	5,140
Protein %	3.33	3.45
Fat %	3.80	4.10
MS kg/cow	337	388
S.R. cows/Ha	1.74	2.1
Replacement rate %	25	22
Herbage utilisation kg/Ha	6,378	8,732

* (NFS, CSO, MPK surveys)

National 2020 Emissions

GHG measure	Method	National	
		2008	2020
kg CO ₂ e/kg milk sold	IPCC	1.13	1.00 (-12%)
	LCA*	1.15	1.03 (-10%)
kg CO ₂ e/kg MS sold	IPCC	15.72	13.15 (-16%)
	LCA*	16.06	13.53 (-16%)
t CO ₂ /ha	IPCC	7.49	8.34 (11%)
	LCA	9.00	9.76 (8%)

*Emissions allocated



Beef



Suckler beef systems

	NFS	Nitrates	Intensive
Stocking rate LU/Ha	1.2	2.2	2.9
Mean calving date	Apr 15th	Mar 16th	Mar 16th
Male finishing period	30 m	16 m	16 m
Heifer finishing period	26 m	20 m	20 m

Results – GHG emissions from suckler beef systems

	NFS	Nitrates	Intensive
On-farm CO ₂ e (t/ha)	4.4	7.2	9.3
Total CO ₂ e (t/ha)	5.7	9.0	12.4
On-farm CO ₂ e (kg/kg beef)	18.4	14.9	14.8
Total kg CO ₂ e (kg/kg beef)	23.4	18.6	19.7

Global comparisons in the literature

Reference	Country	Value (kg CO _{2e} /kg carcass)
Veysset et al. (2009)	France	27.1 (test farm)
Cederberg et al. (2009)	Brazil	28.2
Cederberg et al. (2009)	EU	26.3
Williams et al. (2006)	England	15.8 to 25.3
White et al. (2010)	New Zealand	26 to 34
Foley et al. (2009)	Ireland	23.4



Considerations

- Reduction targets
 - National
 - Global
- Mitigation Strategy evaluation
 - Quantification
 - National
 - Farm
 - Accounting for efficiency?
 - Inventories
- Sequestration



Sequestration

- **Phillip O Brien** (A Climate for Change 2010)

“Irish Grassland sequesters 4 tCO₂e/Ha/year”

- **Mike Jones** (A Climate for Change 2010)

“Irish grassland sequesters between 7 & 15

tCO₂e/Ha/Year”

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Moorepark (2010)	Ireland sequestering 4t/Ha	0.64
Moorepark (2010)	Ireland sequestering 7t/Ha	0.26

Conclusion

- Grass based systems produce less emissions per unit product
- Emissions per unit product will reduce through mitigation strategies
- IPCC methodology not complete picture
- Policy implementation
 - Blanket reduction
 - Increased efficiency