



# GHG emissions and agriculture

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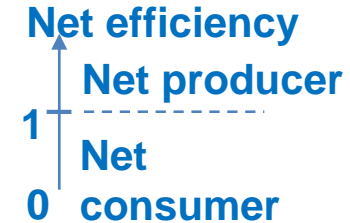
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# Grass fed – Protein efficiency



$$\text{Total Efficiency} = \frac{\text{Proteins produced (whole carcasses, milk)}}{\text{Proteins consumed by livestock (total feed)}}$$

$$\text{Net Efficiency} = \frac{\text{Human edible proteins produced}}{\text{Human edible proteins consumed}}$$

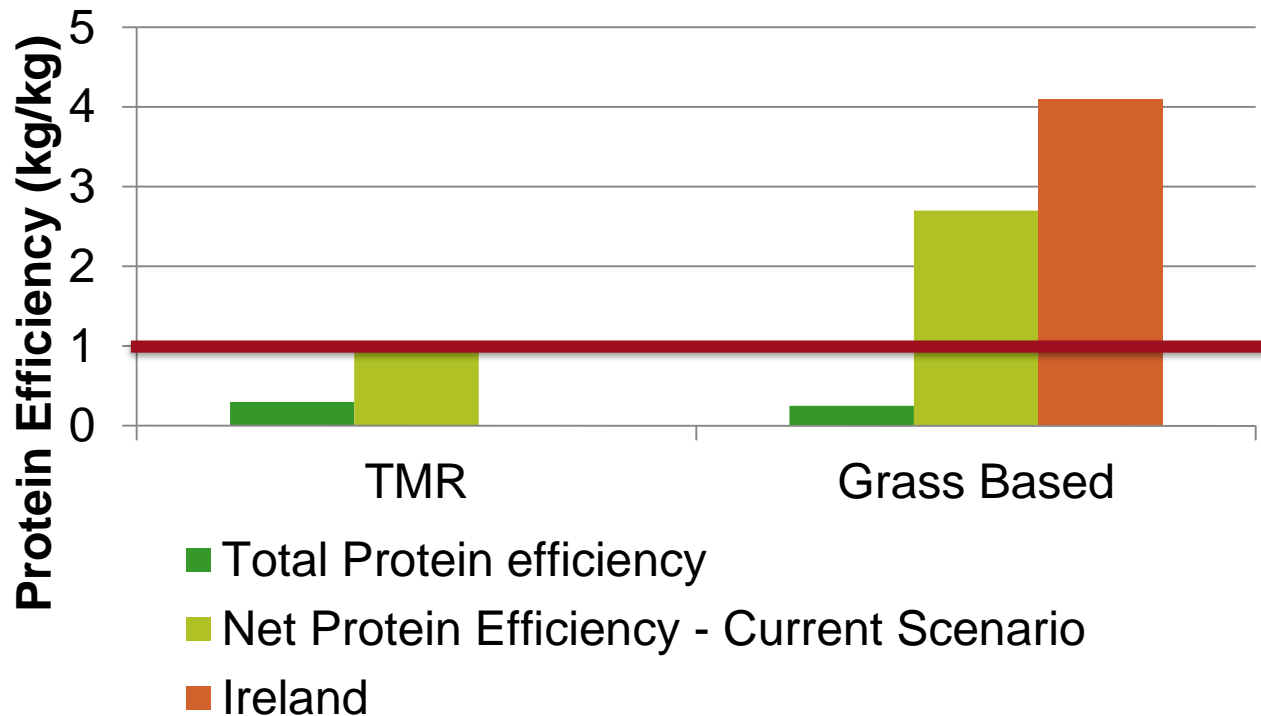


(adapted from  
Wilkinson, 2011;  
Ertl et al, 2015)

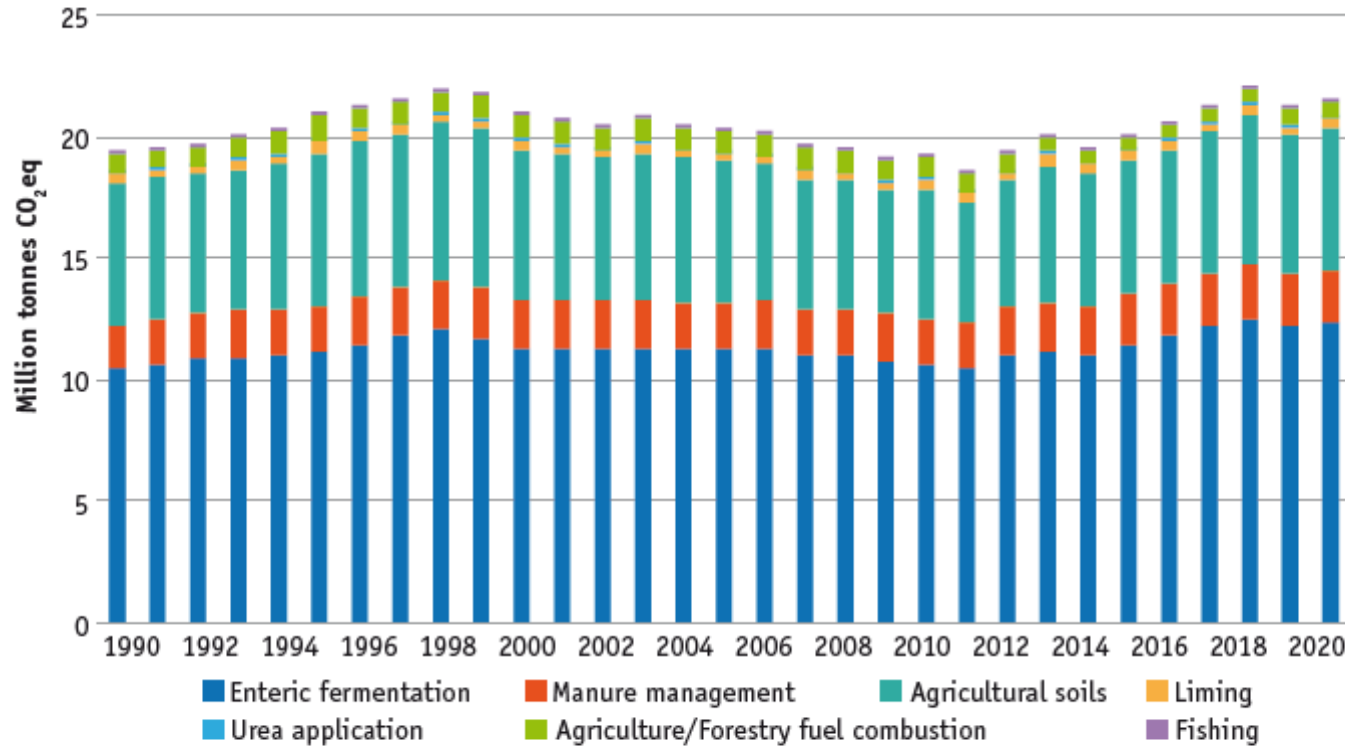
→ What is human-edible ?

Laisse et al., 2018

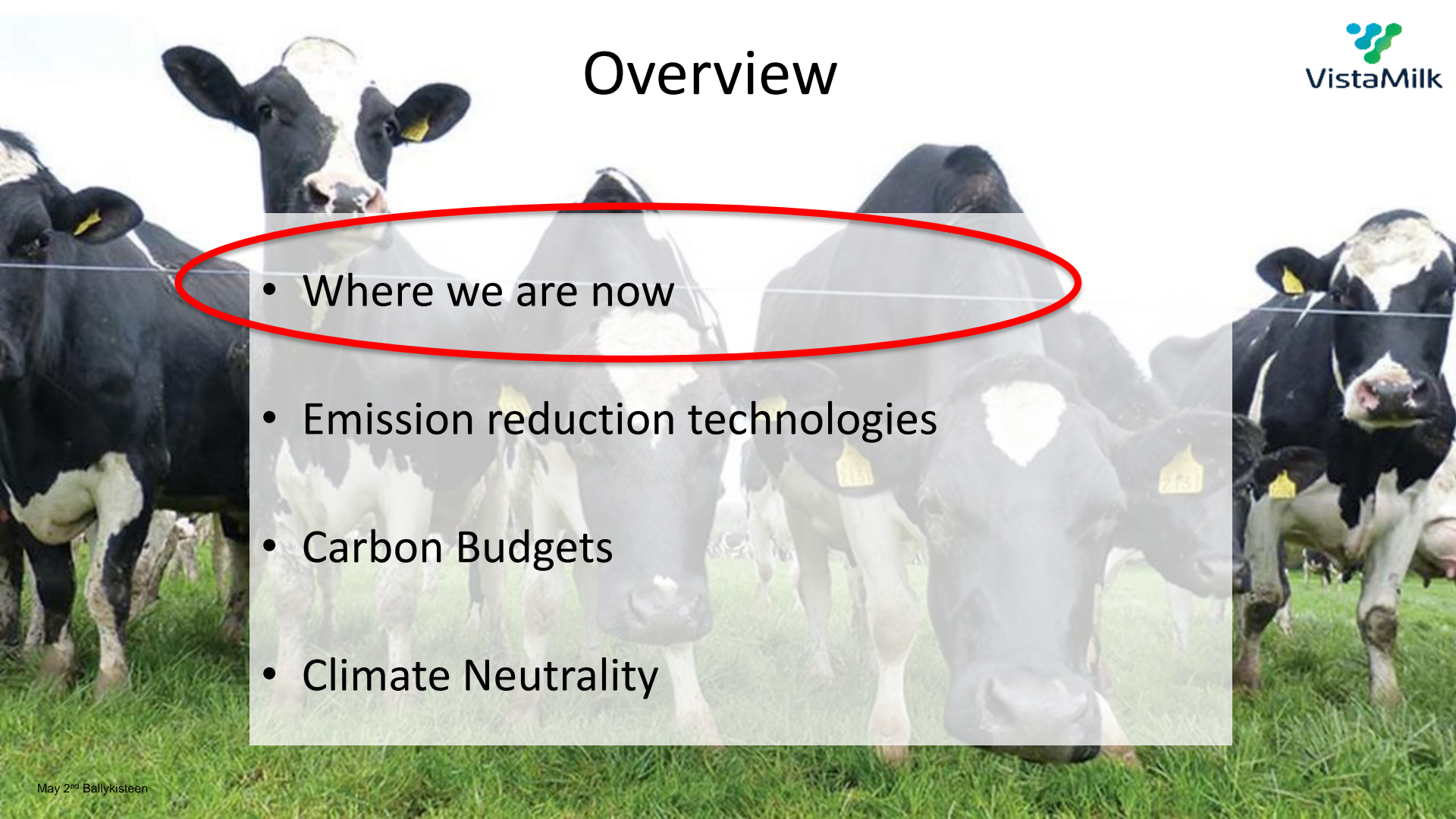
# Grass fed – Protein efficiency



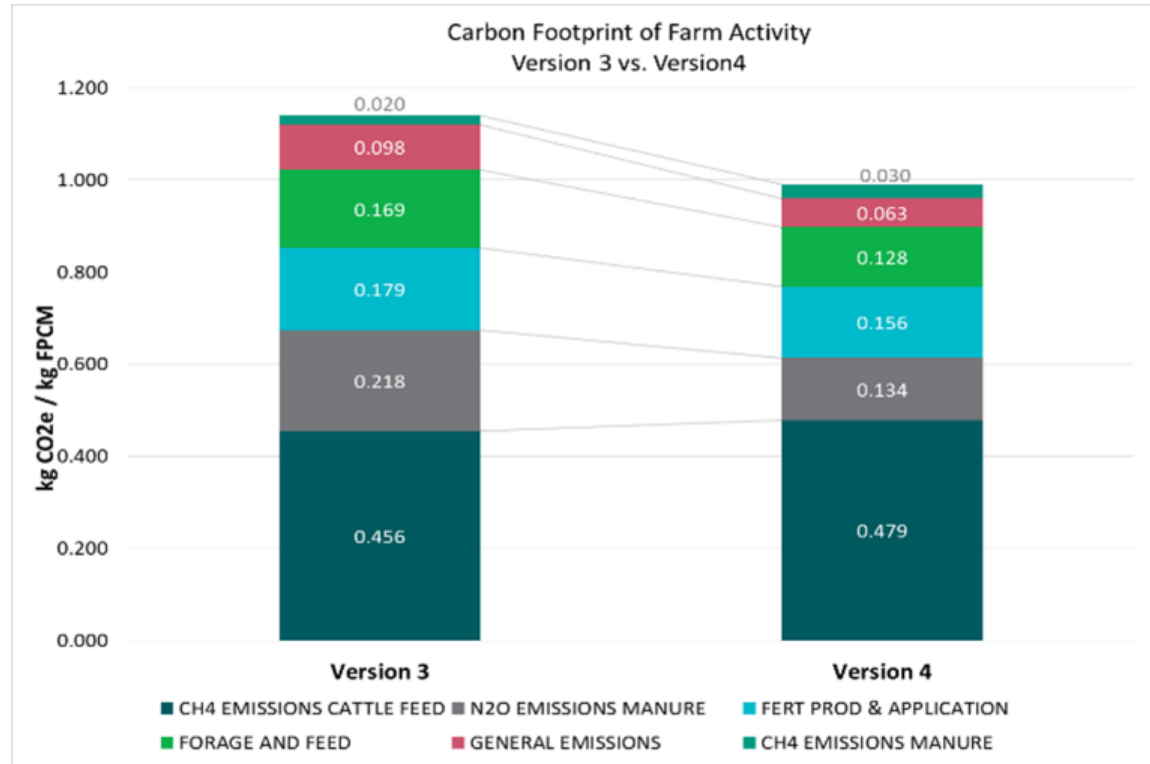
# Irish Emissions (UNFCCC)



# Overview

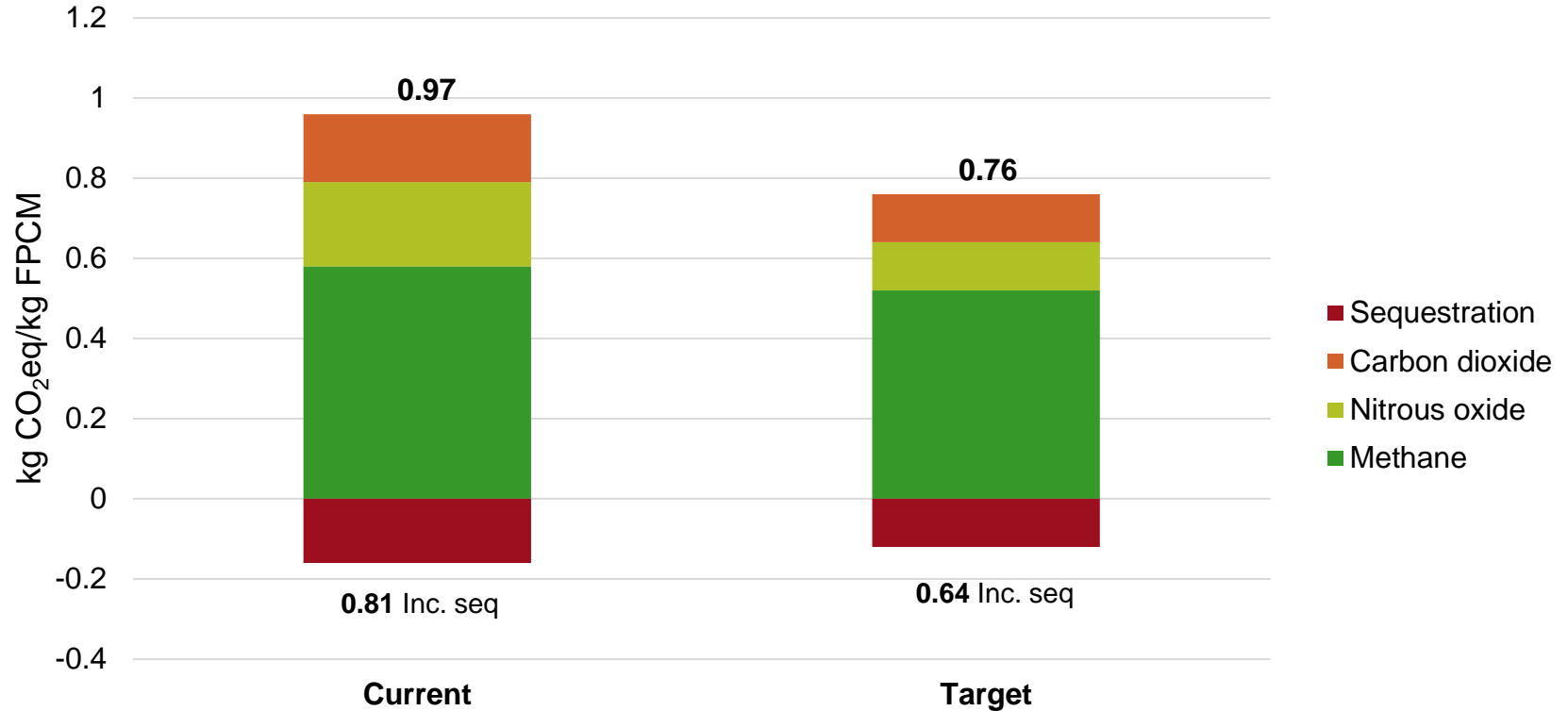
- 
- Where we are now
  - Emission reduction technologies
  - Carbon Budgets
  - Climate Neutrality

# Carbon footprint Model updates



Herron et al., 2022

# Current and Target systems





# Overview

- Where we are now
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# EBI - Environmental footprint of the Next Generation Herd

	Elite (€181)	NatAv (€80)
CO <sub>2</sub> -eq, tonnes / ha	16.2	16.3
FPCM, kg	16879	15326
CO <sub>2</sub> -eq, kg / kg FPCM	0.96	1.06

**€10 increase in EBI = 1%  
less  
CO<sub>2</sub>-eq kg / kg FPCM**



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## Greenhouse gas emissions and nitrogen efficiency of dairy cows of divergent economic breeding index under seasonal pasture-based management

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# Feed and Productivity

- Increasing productivity from grass
  - >25kg MS per lactation = - **2.1%** per kg FPCM
- Reducing the levels of feed supplemented while holding milk production
  - <250kg per cow = - **1.4%**
- Reducing replacement rate
  - 20% to 16% = - **2.2%**



# Nutrients

- Reduced Chemical N
  - Soil Fertility, Clover, LESS
  - <25kg N = - **2.5%**
- CAN Versus Urea based fertiliser
  - Four fold difference in emissions
  - Protected urea for ammonia emissions
  - Full CAN to Urea = -**8.7%**



# Overview

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# Achieving Sectoral Target

- Agriculture's Target Reduction 21.7% to 30%
  - 2018 agricultural emissions 22.034m t
    - Movement from AR4 to AR5
      - The GWP value for Methane 25 to 28
      - The GWP value for Nitrous Oxide 298 to 265
  - 2018 emissions recalculated to be 23 m t
  - Target reductions
    - Between 5 and 7 m t (21.7% to 30%)
  - Three categories of reduction
    - Currently available technologies from original MACC (Current technologies)
      - 2 million t
    - Research close to delivery and activities not included in original MACC
      - 1.5 million t
    - Achieving the balance
      - 1.5 to 3.5 million t

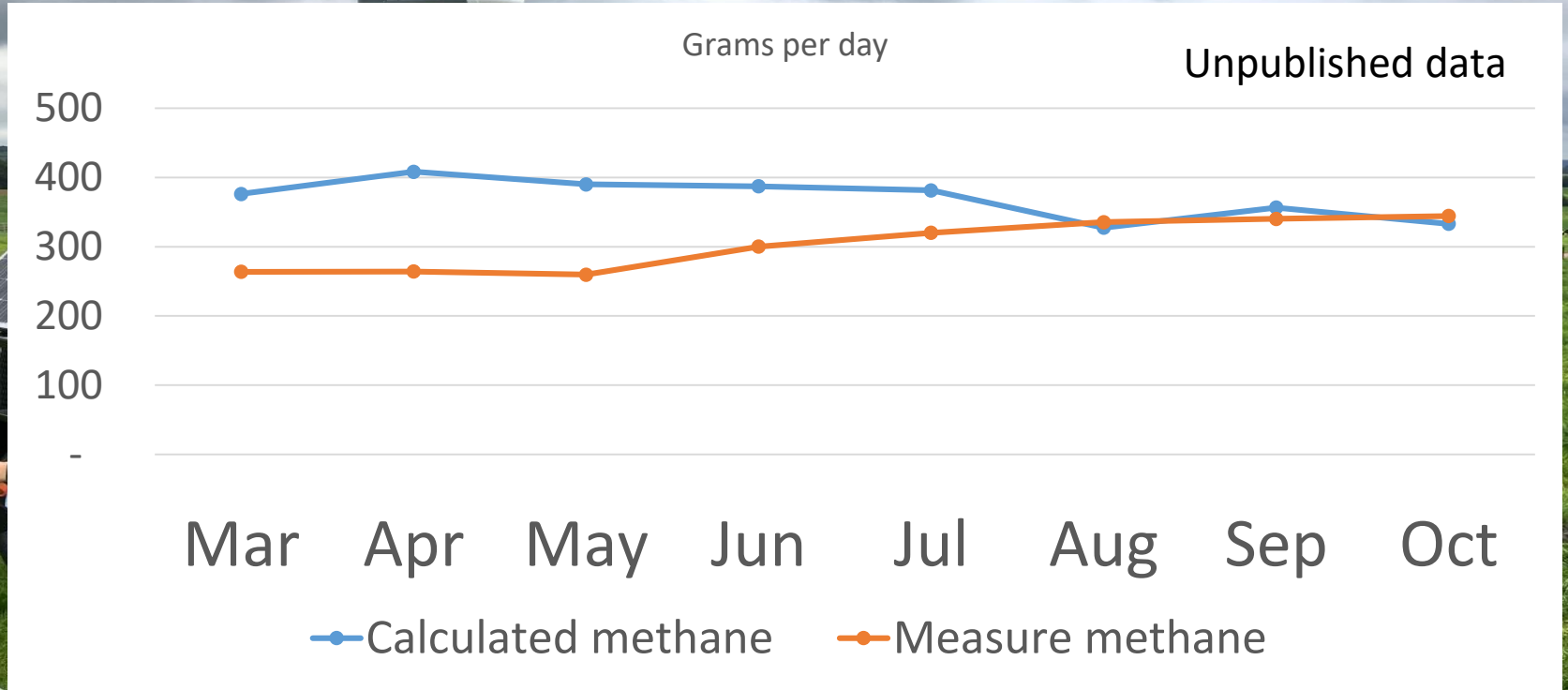
# Achieving the balance – Research

## Distance to target 1.5 to 3.5 million tonnes

- Enteric methane emission factor
  - Current value 6.5% of GEI at grazing
  - Yan et al., for grass silage (Kennedy data, Substantially lower)
- Research data
  - O'Neill et al., (2011) – 5.74% to 5.93%
  - O'Neill et al., (2012) – 7.70% to 7.98%
  - Wims et al., (2010) – 5.4% to 7.4%
  - Jiao et al., (2014) – 5.3% to 5.9%
  - Hynes et al., (2016) – 5.6%



# Methane Research



May 2<sup>nd</sup> Ballykisteen

# Achieving the balance – Research

## Distance to target 1.5 to 3.5 million tonnes

- Enteric methane emission factor
  - Current value 6.5% of GEI at grazing
  - Yan et al., for grass silage (Kennedy data, Significantly lower)
  - Research data
    - O'Neill et al., (2011) – (5.74% to 5.93%)
    - O'Neill et al., (2012) – 7.70% to 7.98%
    - Wims et al., (2010) – 5.4% to 7.4%
    - Jiao et al., (2014) – 5.3% to 5.9%
    - Hynes et al., (2016) – 5.6%
- Feed additives
  - 3NOP showing promise in indoor systems (circa 30%)
    - Early life 3NOP showing promise
    - Will it work at pasture?
  - Asparagopsis
- Zelp
- Breeding
- System