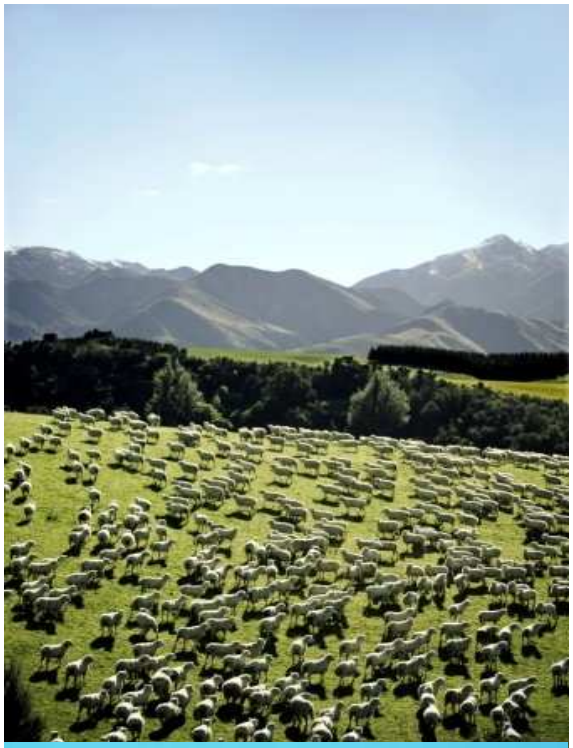
AGRICULTURE, GREENHOUSE GAS EMISSIONS AND CARBON FOOTPRINTING OF PRODUCTS: a New Zealand perspective



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NEW ZEALAND LIFECYCLE MANAGEMENT CENTRE

Outline of talk:

1. The issue and drivers of change

2. Milk

   - results & reduction options

   - methodology aspects

3. Lamb

   - results & reduction options

   - methodology aspects

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The issue ?

Within NZ:

- Kyoto Protocol & Emissions Trading Scheme
  - Carbon payment for tree planting
  - Carbon tax on fuel & electricity (c. 4-5%)
  - Animal CH_4 & N_2O tax in 2015?

The issue ?

International:

- Food-miles → Carbon footprinting

- Supermarkets - *Eco-labelling*

  - becoming a supply requirement

- Fresh - something is always “in season” somewhere!

Agricultural trade has been driven by **cost-efficiencies**, BUT now we also need to account for **environmental efficiencies**

Agriculture is a significant contributor

Livestock production occupies:

- 70% of all agricultural land
- 30% of planet's land surface

Livestock production produces:

- 18% of all GHG emissions
  (> all global transportation)
- the largest contribution to eutrophication

BUT, it:

- provides livelihood for 20% of world's population
- provides 1/3 of all dietary protein intake

2. Milk

First of NZ

Industry-led projects on Product carbon footprinting

The carbon footprint lifecycle

Fonterra
Dairy for life

ON-FARM

85%

PROCESSING

10%

DISTRIBUTION

5%

NEW ZEALAND

EUROPE

Origin of on-farm greenhouse gas emissions

Fonterra
Dairy for life

refrigerants 0.2%

Methane
59%

Rumen	96%
Dung	2%
FDE	2%

N_2O
24%

Excreta	71%
N fertiliser	25%
Manure	3%
Crop residues	1%

CO_2
17%

Land change	33%
N fertiliser	34%
P,K,S fert.	12%
Lime	5%
Fuel	7%
Electricity	8%

What to do with the results?

- **Make available to purchasing companies**
- **Identify "hot-spots" & reduction opportunities**
- **Do we release our carbon footprint number?**
  or **do we only release hot-spot data and efforts on improvement?**

The public want to see comparisons

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What is the relevant functional unit?

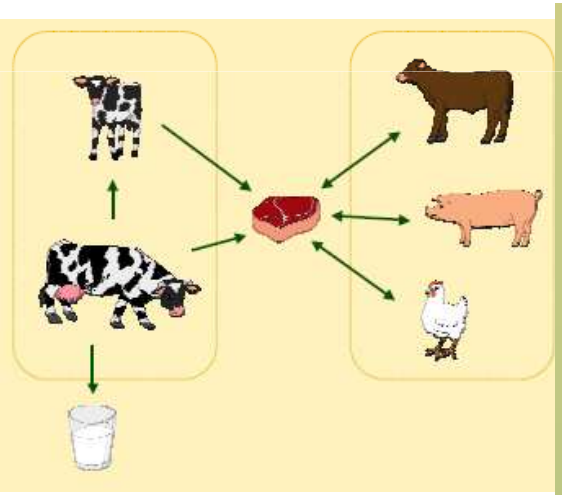
	kg CO_2-equiv. per kg or per litre
Coca-cola	<0.25
Apples	0.3
Milk	1
Lamb	9

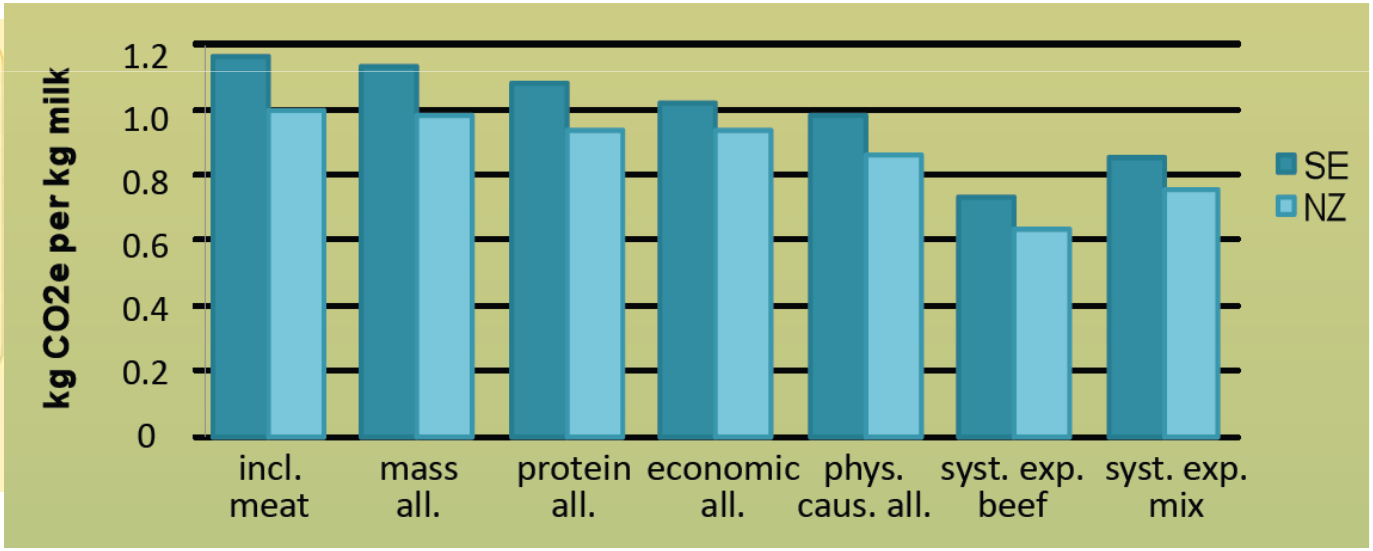
What is the relevant functional unit?

	kg CO_2-equiv. per kg or per litre	kg CO_2-equiv. per kg protein
Coca-cola	<0.25	Infinity !
Apples	0.3	90
Milk	1	30
Lamb	9	40

Key methodology aspects:

- **Need to account for all contributors ("system boundary"), particularly for brought-in feeds e.g. soybean & deforestation**
- **Allocation between co-products**





Flysjo, Cederberg, Henriksson & Ledgard (2011)

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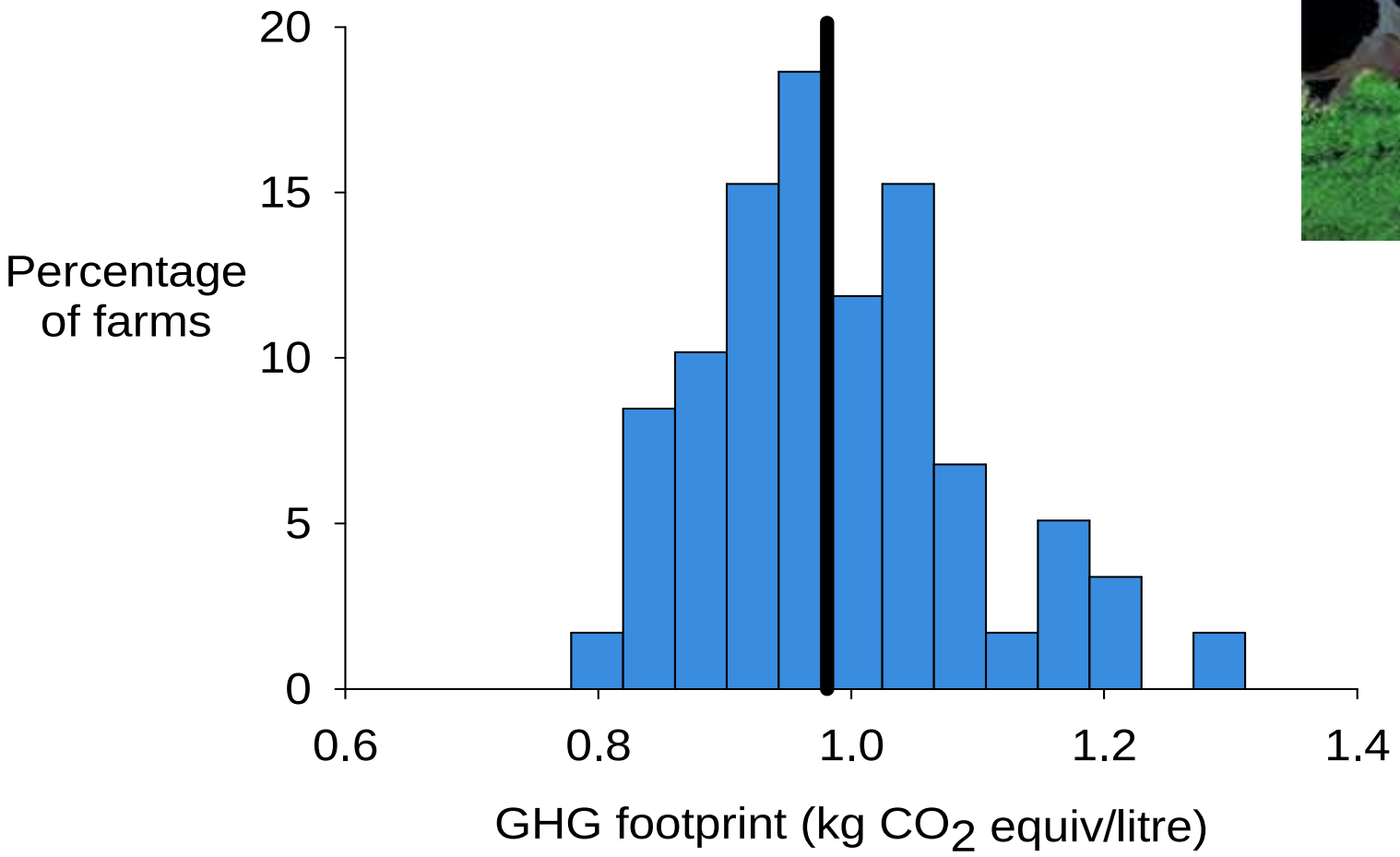
Bulletin
of the International Dairy Federation
445/
2010

A common carbon footprint approach for dairy
The IDF guide to standard lifecycle assessment methodology for the dairy sector

Wide variability between individual dairy farms (Waikato region)



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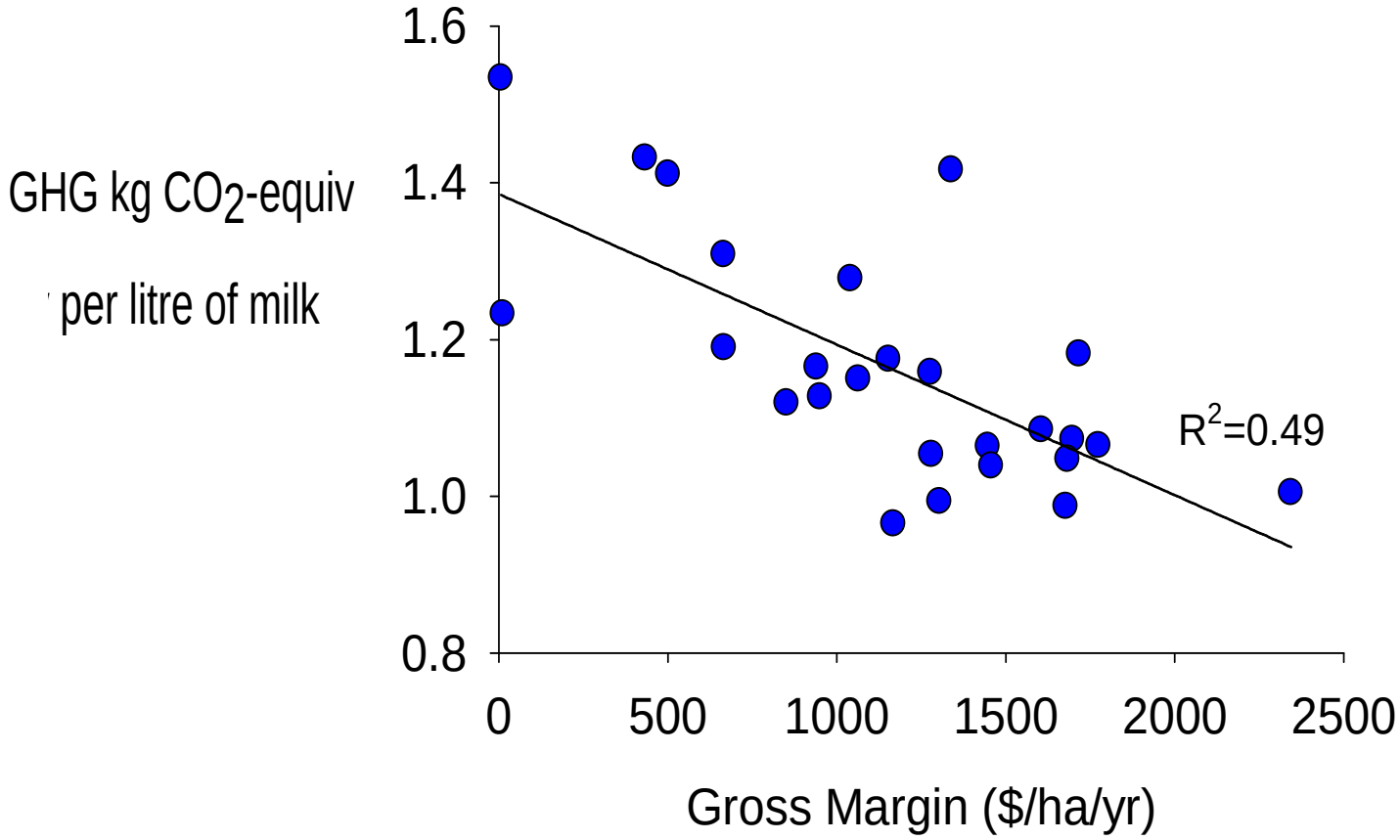
Fonterra
Dairy for life

Wide variability between individual dairy farms (Waikato region)



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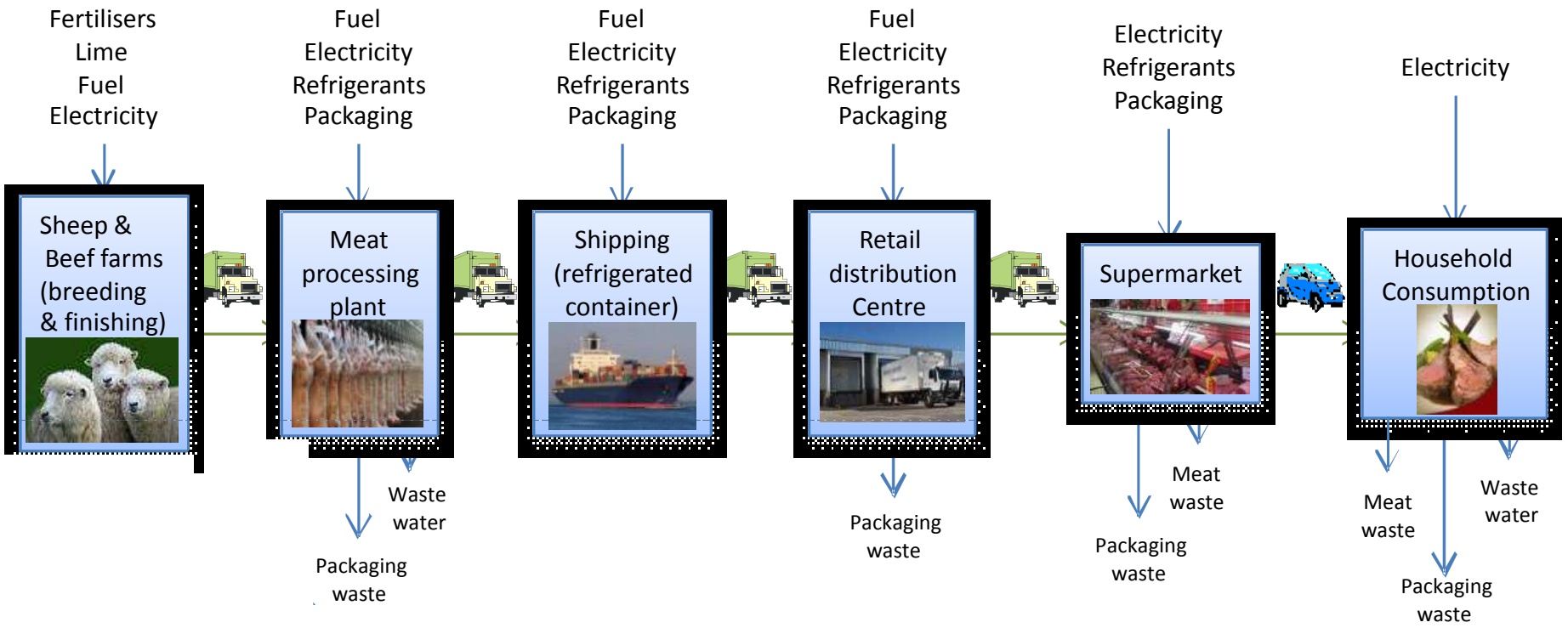
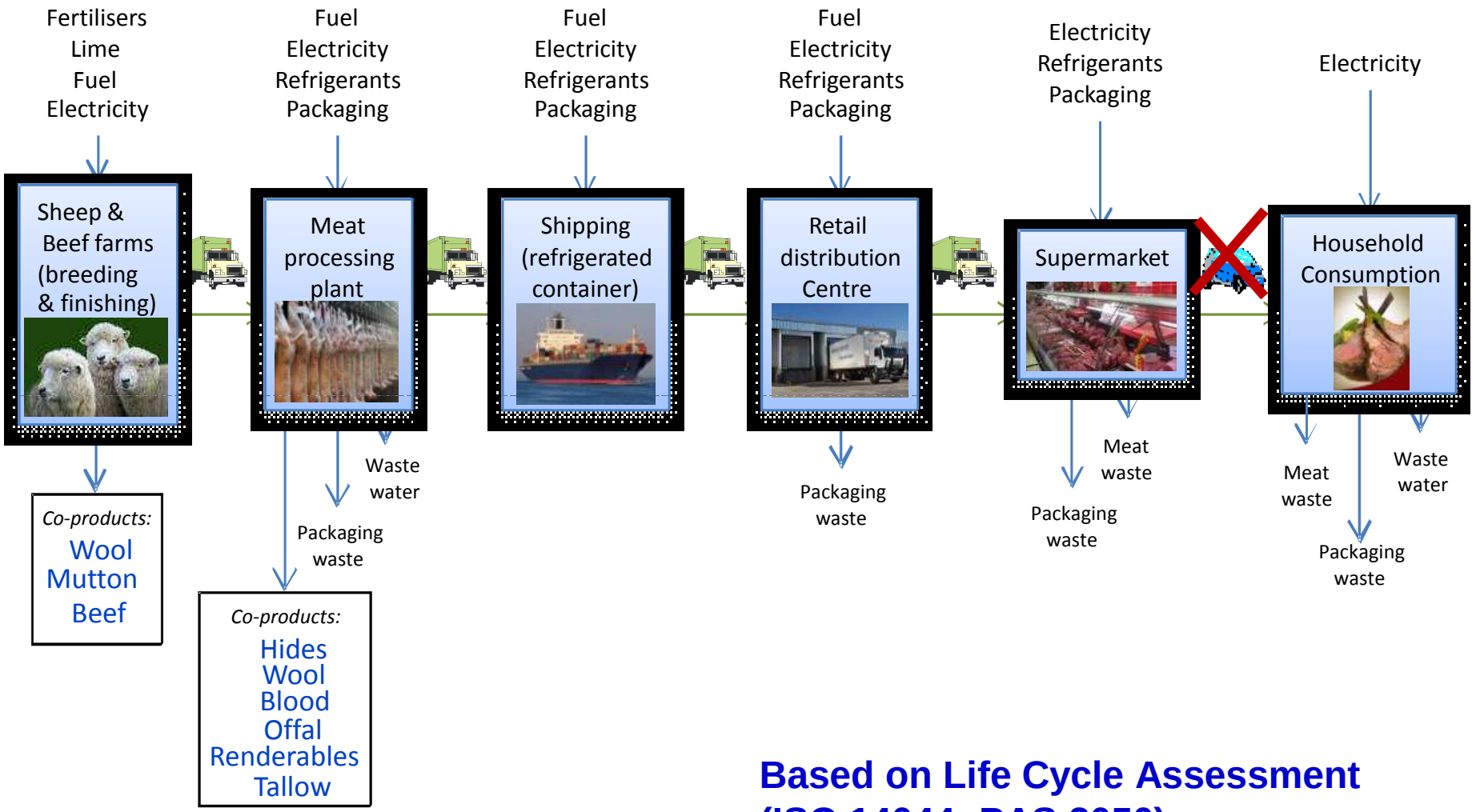
Dairy for life

3. Lamb

Life cycle of lamb to the U.K.



Life cycle of lamb to the U.K.



Based on Life Cycle Assessment (ISO 14044; PAS 2050)

Data

Farms:

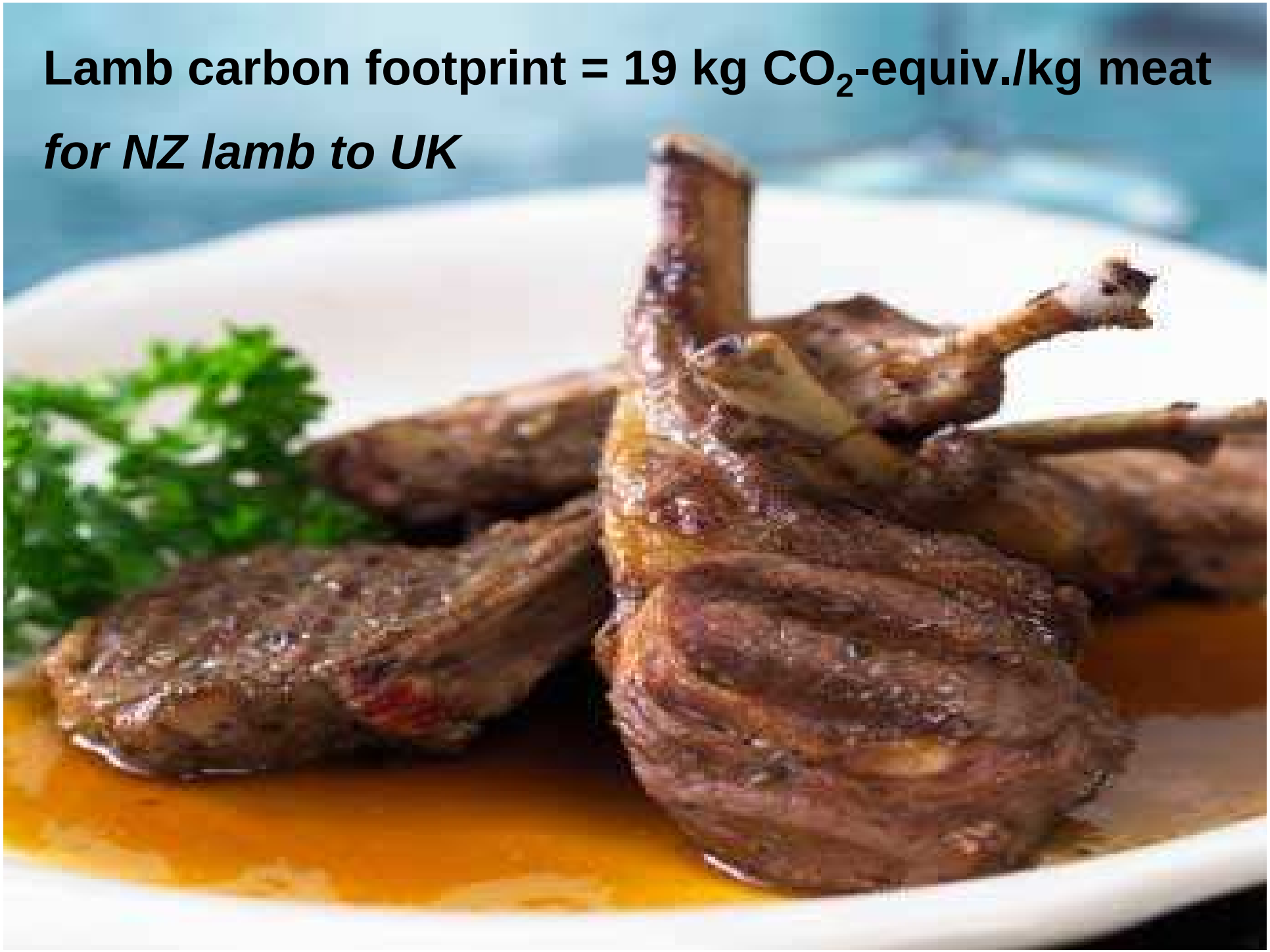
- survey farm data (>460 farms over 7 farm classes)
- tier-2 method to estimate feed energy intake
- some NZ-specific E.F.s e.g. 20.9 g CH_4/kg DM intake

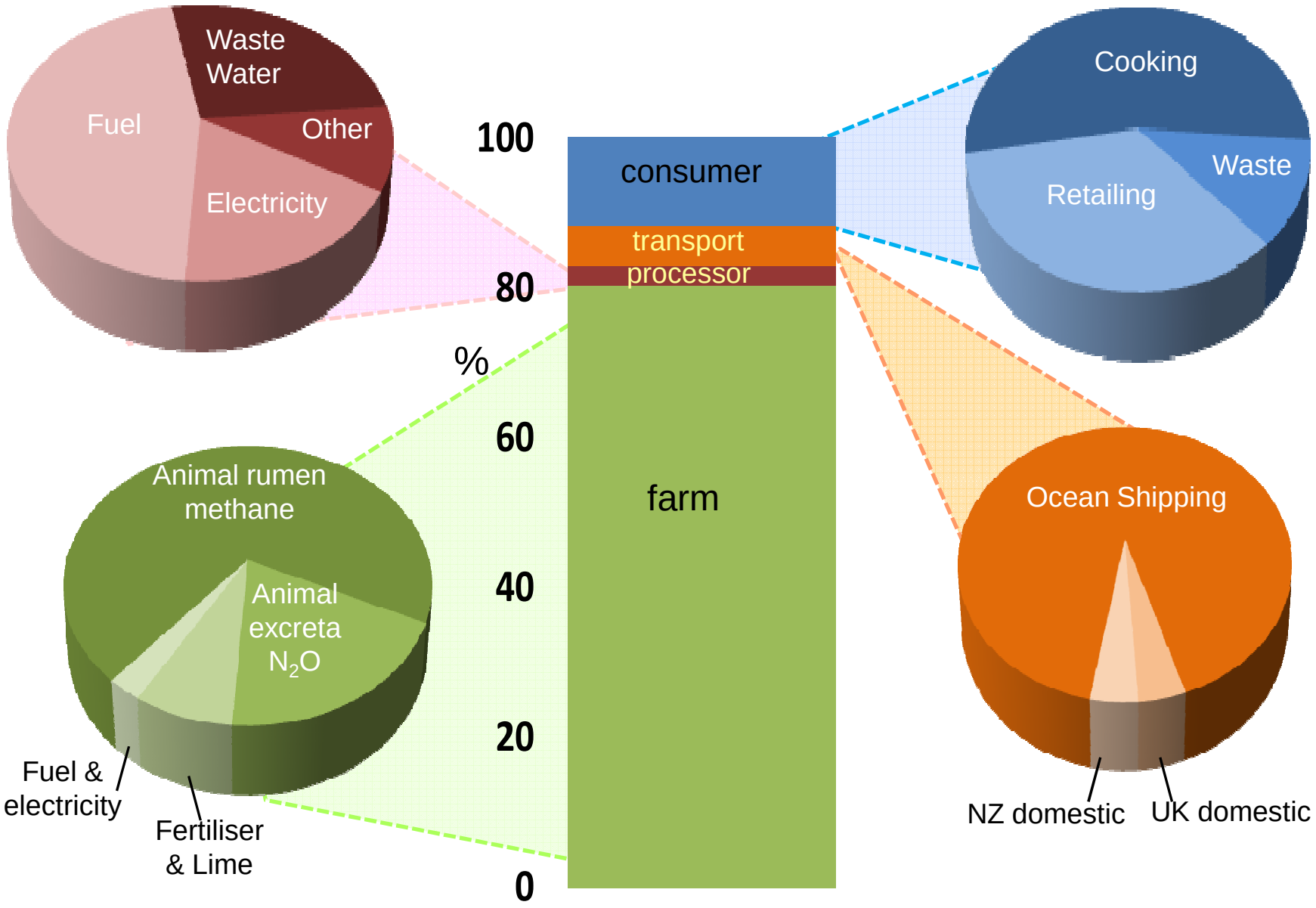
Meat processing plants:

- survey data from 11 plants (>40% all lambs)
- covered energy use, waste-water processing, refrigerants, consumables etc.

Transport/retail/consumer/waste:

- mainly 2^o data modified for country-specific emissions


Lamb carbon footprint = 19 kg CO_2-equiv./kg meat
for NZ lamb to UK


Waste
Water
Fuel
Other
Electricity
100
consumer
transport
processor
80
%
60
farm
40
20
0
Cooking
Retailing
Waste
Animal rumen
methane
Animal
excreta
N_2O
Fuel &
electricity
Fertiliser
& Lime
Ocean Shipping
NZ domestic
UK domestic

SENSITIVITY ANALYSES: consumer

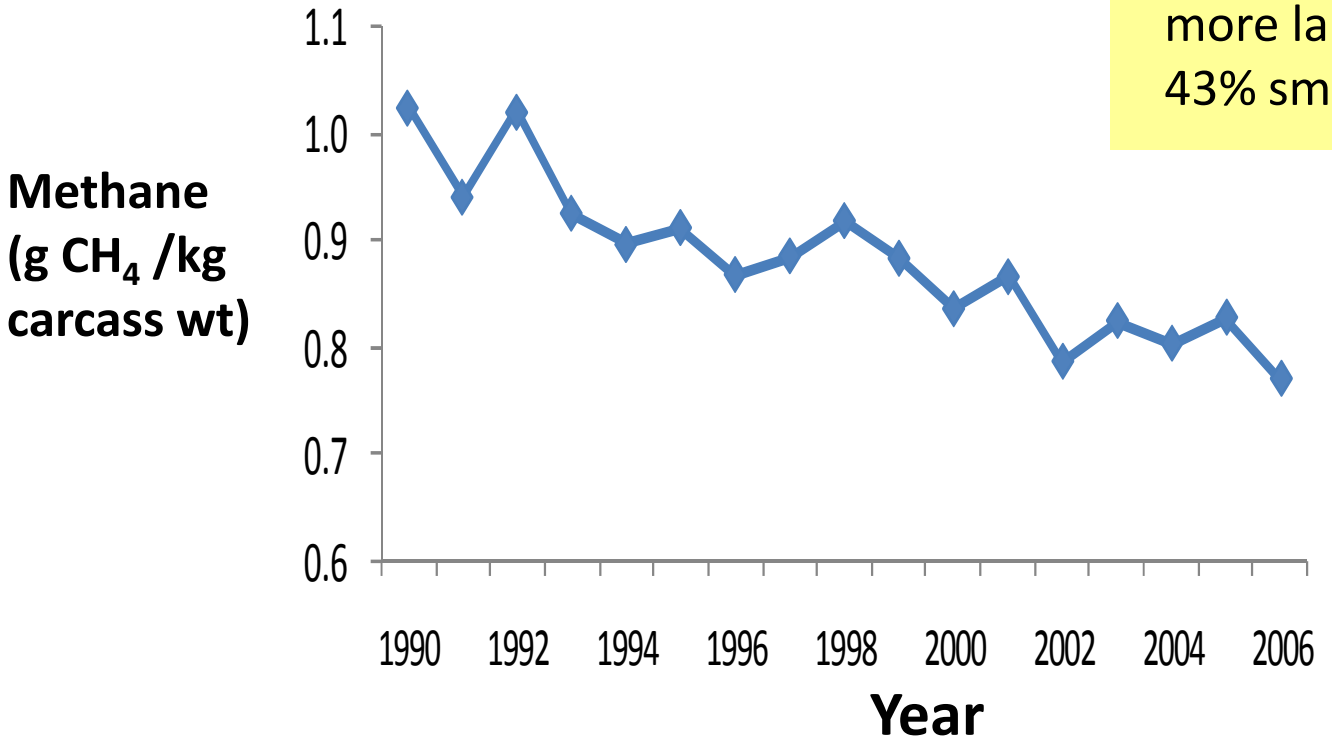
Cooking method:
roasting had 11% higher consumer/retail emissions than frying, or a 1% increase in total carbon footprint

Inclusion of **consumer travel** gave an increase of up to 7% in the total carbon footprint
(> all other transport stages combined)

Key methodology aspects:

1. **Using a tier 2 animal energy intake model for feed intake accounts for productivity gains**

NZ sheep meat average:



Compared to 1990, NZ sheep farms in 2009 produced slightly more lamb meat, but from a 43% smaller flock

Key methodology aspects:

2. Allocation between co-products

- sheep versus cattle — **biophysical allocation**
- sheep meat versus wool — **economic allocation**

Allocation method	% allocation to meat
Economic	77%
Mass	85%
System expansion (acrylic fibre for carpets)	81%

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Key methodology aspects:

2. **Allocation between co-products**

   - **sheep versus cattle** — **biophysical allocation**
   - **sheep meat versus wool** — **economic allocation**
   - **sheep meat co-products** — **economic allocation**

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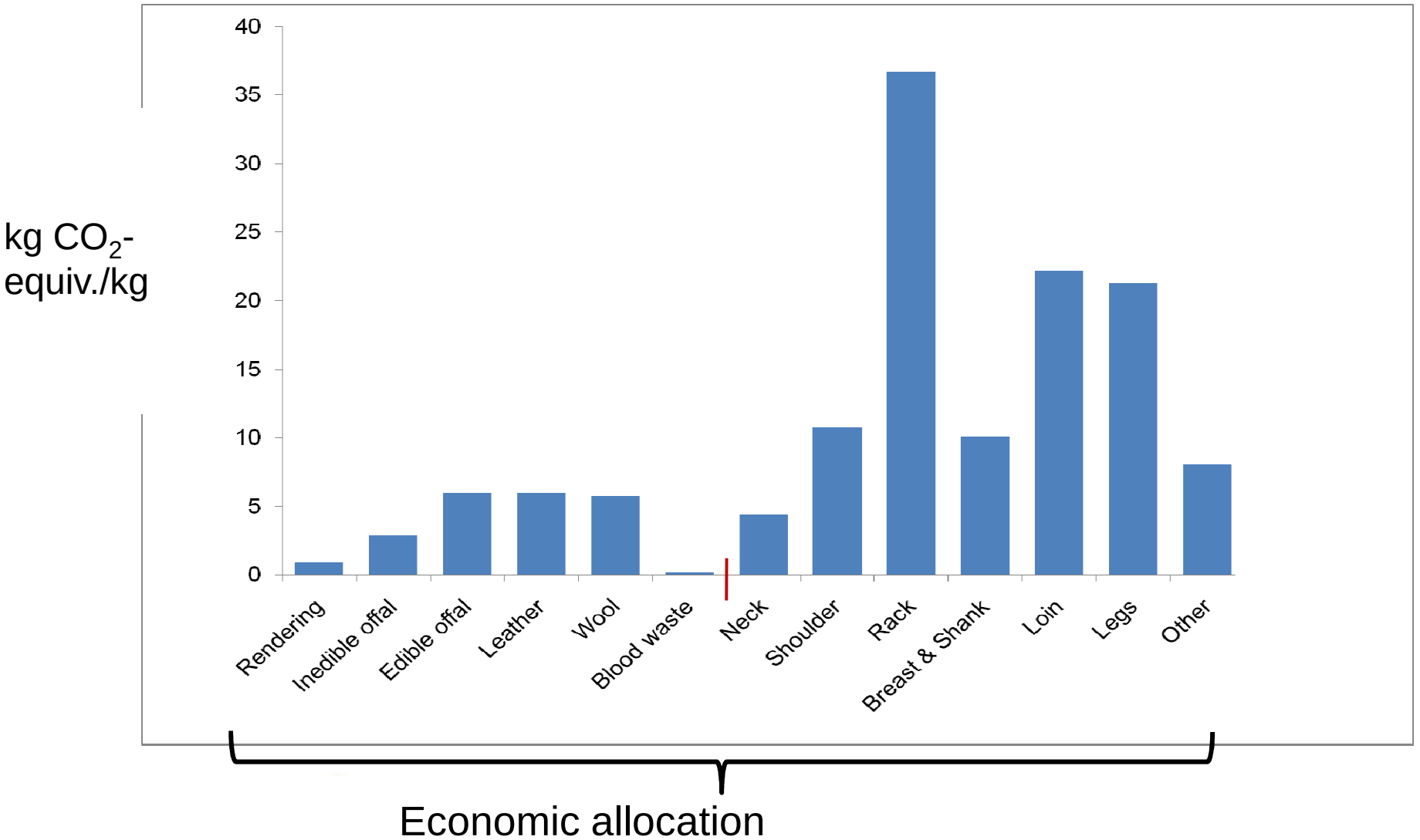
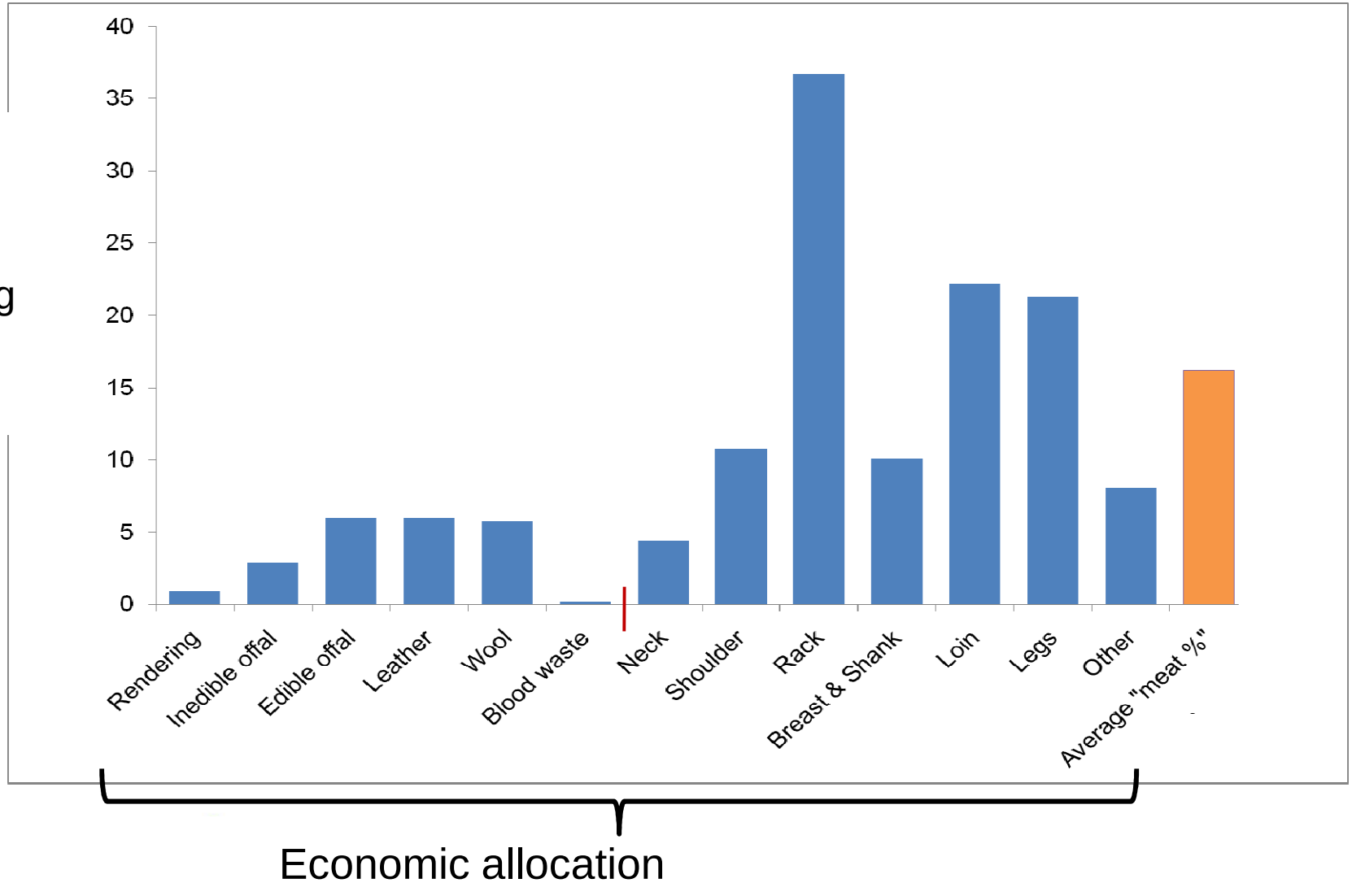
Economic allocation of lamb co-products



Economic allocation of lamb co-products



Developing an internationally-agreed methodology

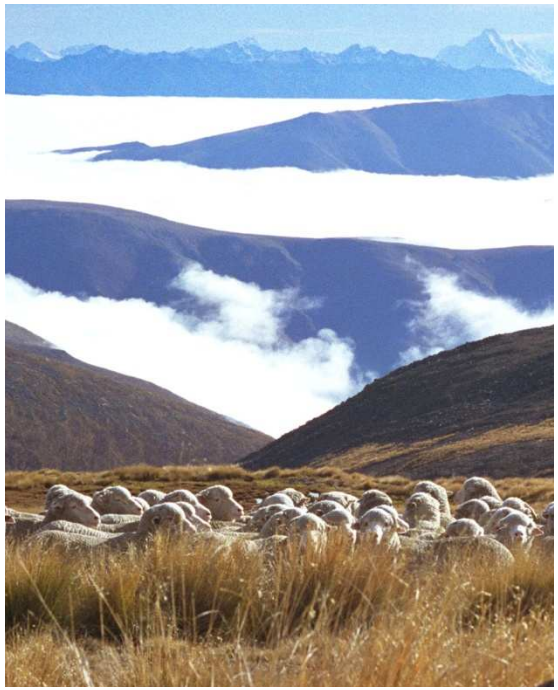
Lamb sectors internationally and LCA researchers are working on an agreed carbon footprint methodology

– initiated by Beef+LambNZ and International Meat Secretariat

LCA & other environmental impact categories

- **Avoid trade-offs e.g. ↓ carbon footprint**
  BUT ↑ eutrophication potential

- **Appropriate methods e.g. Biodiversity indicator = land area !**



Summary:

- Agricultural trade considers cost efficiency BUT it must also account for environmental efficiency
- Need to recognise GHG emissions through the life cycle of products
- Use of LCA requires key choices:
  - Relevant & equitable methodology
  - Methods that account for improved practices and mitigations
  - Allocation between co-products
  - Don’t ignore other resource and environmental impacts

Need for internationally-agreed methodology

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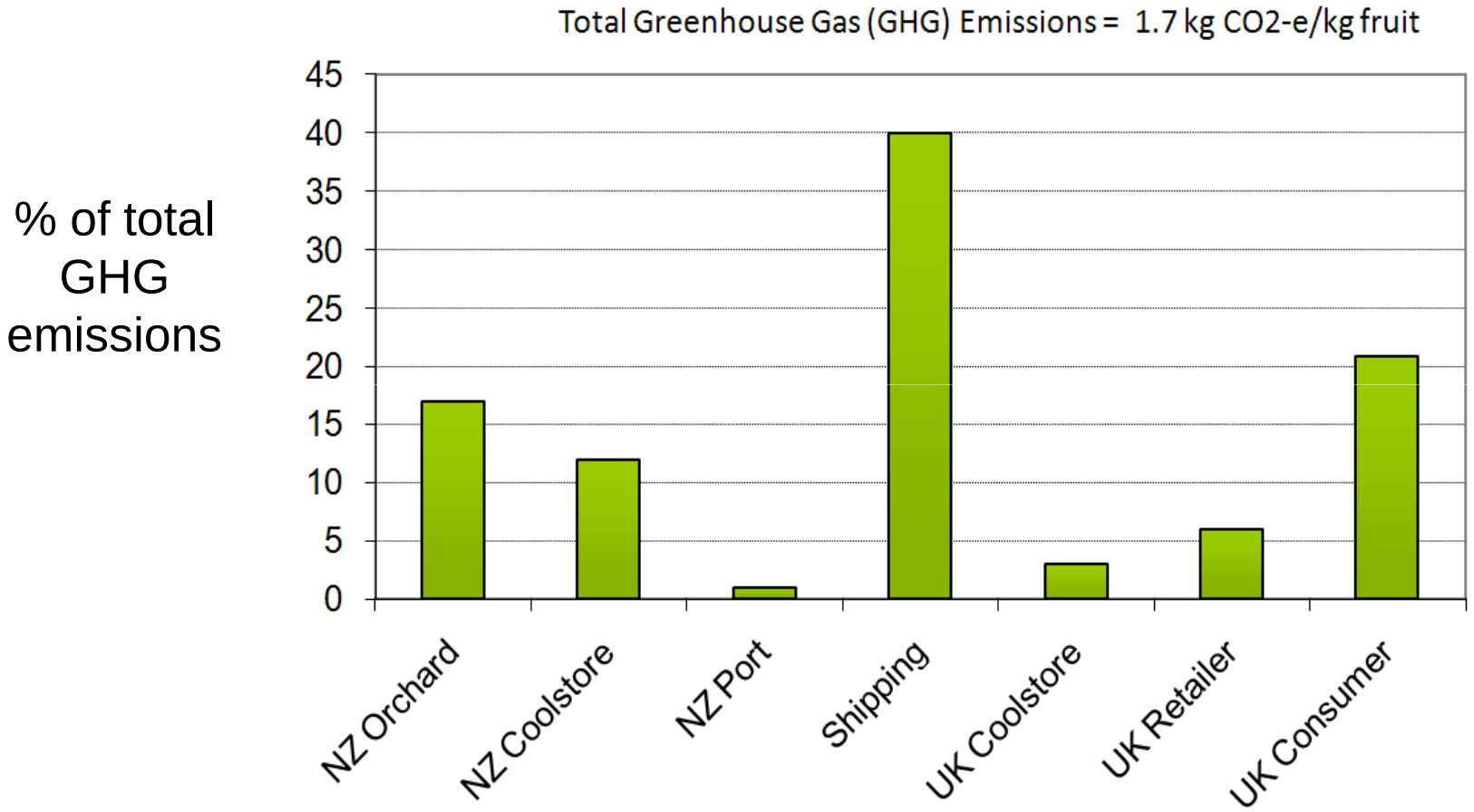
CARBON FOOTPRINT OF NZ KIWIFRUIT TO THE UK



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Mithraratne et al. 2010