Life cycle assessment of tea produced in Kenya

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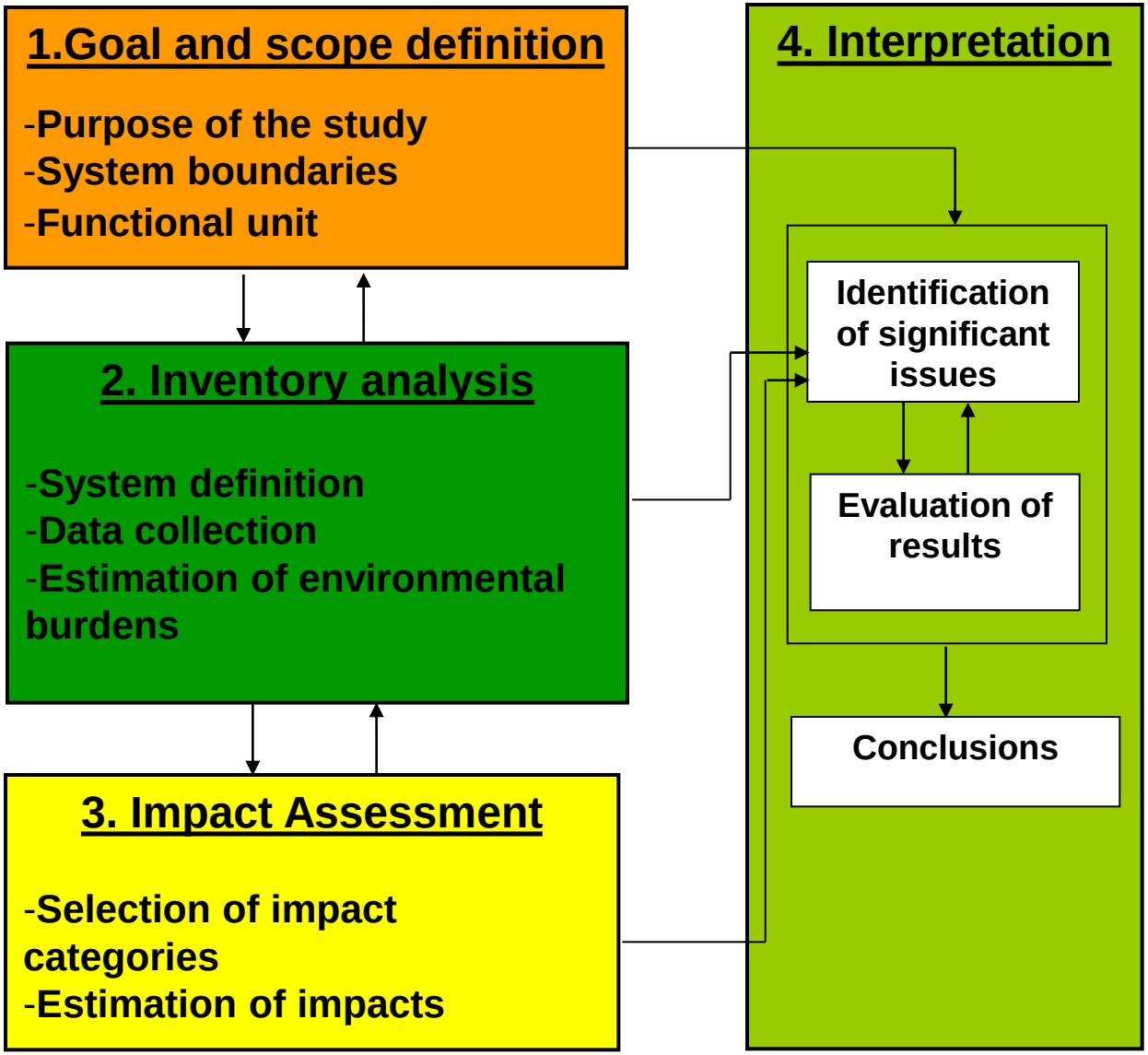
Environment · Technology · Society

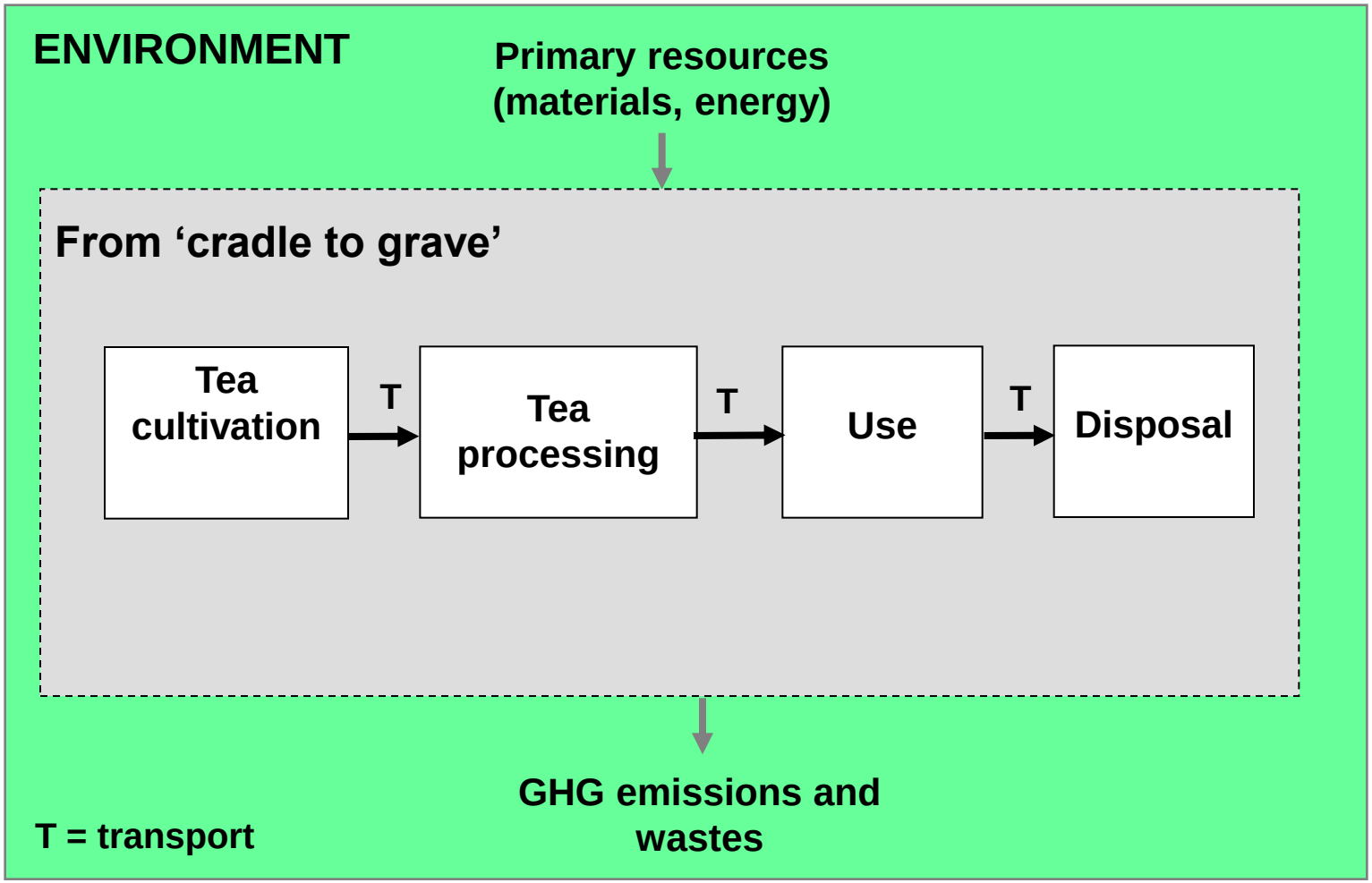
LCA methodology



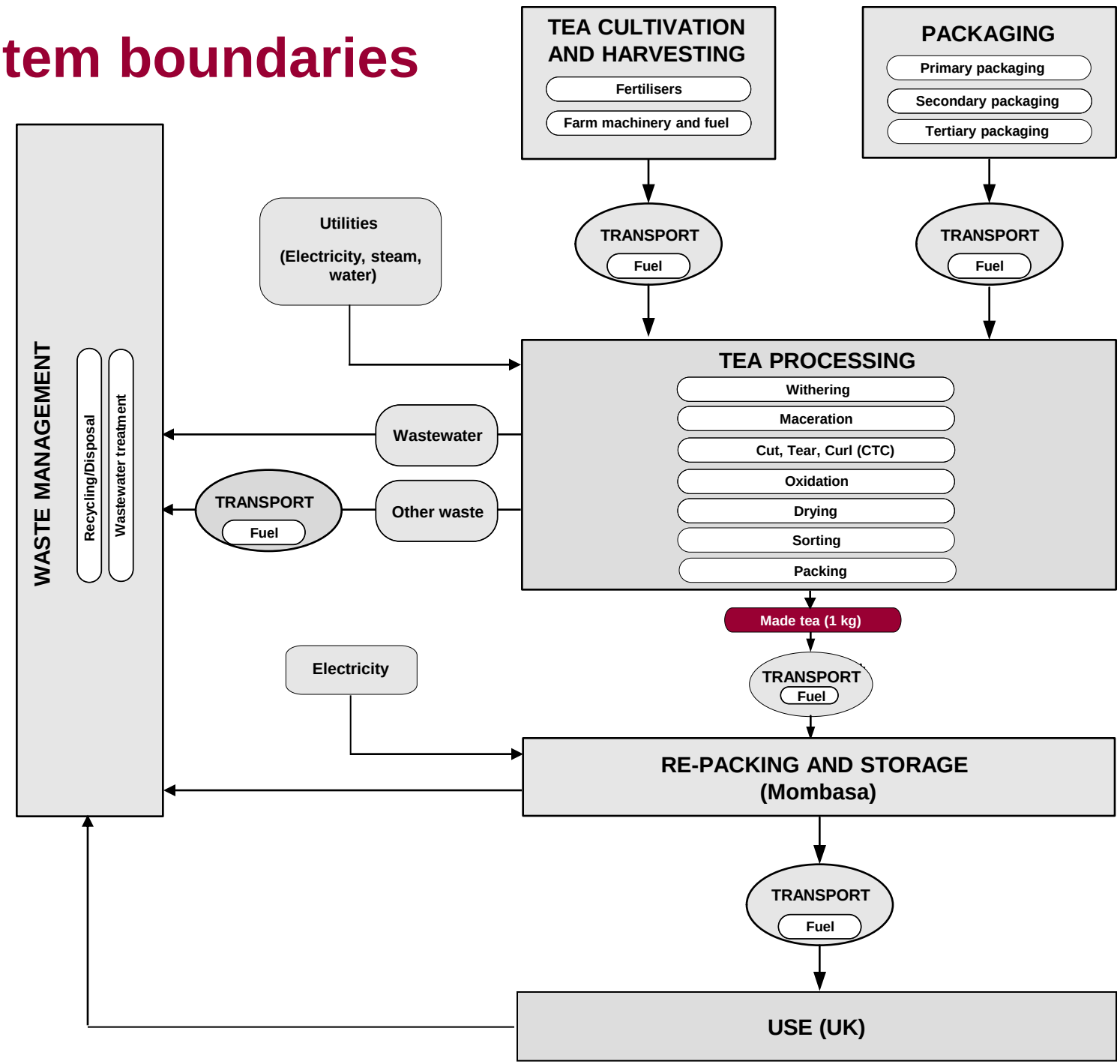
Goal and scope of the study

- Goal
  - To estimate the carbon footprint of tea production in Kenya
- Scope
  - From ‘cradle to grave’
- Functional unita:
  - 1 kg of dry tea
  - 1 tea cup

System boundaries



System boundaries



System boundaries

- All activities from cultivation to end-of life, including
  - Land use change
  - Direct and indirect emissions from fertiliser use
  - Transport
  - Packaging
  - Consumer preparation of tea
  - Waste management options

Data and assumptions: Average production from 2007-2012

Fresh tea leaves	16,350-19,650	t/yr
Dry tea	3600-4350	t/yr
Fresh tea per kg or dry tea	~4.5	kg/kg

Data and assumptions: Land use change

New land each year	37-136	ha/yr
Average land under cultivation	1200-2000	ha

Data and assumptions: Energy

	Source	Amount (kWh/kg tea)
Tea production	Electricity	0.44-0.56
	Heat (wood)	4-23
Use	Electricity	14
Total		18-37

Data and assumptions: Packaging

Fertiliser	PE bags
Fresh tea	HDPE bags
	PP bags
Dry tea, large bags	Paper for the bag
	Aluminium for the bag lining
	Polyethylene for the bag
	HDPE for the bag lining
	Polyethylene film
	Wood
	Slip sheet (compacted carton)
Dry tea, small pack	Kraft paper
	Corrugated cardboard
	Bleached board
	PE film
	Cellulose

Total packaging:

~1.1 kg/kg tea

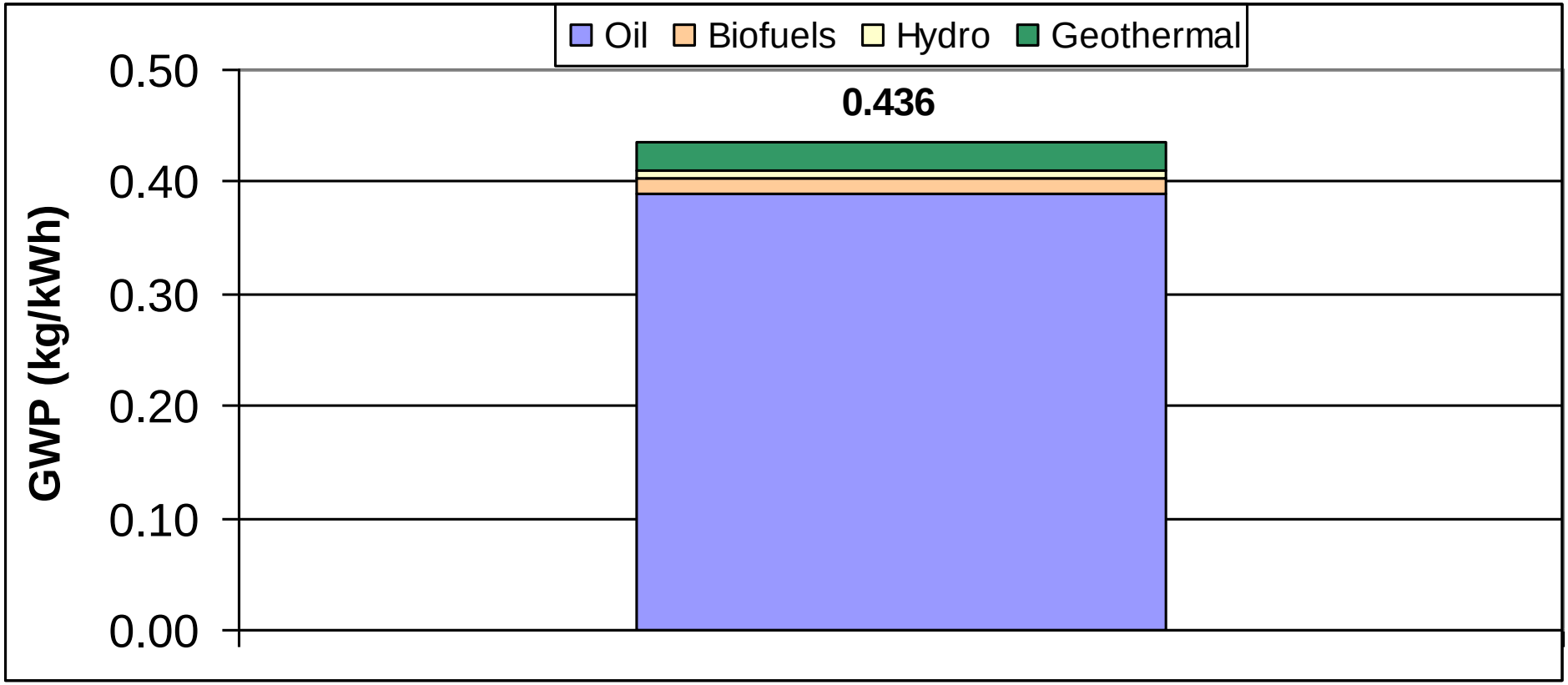
Data and assumptions: Transport

Material	Mode	Distance (km)
Fertiliser	40 t truck	11920
Fertiliser bags	40 t truck	11920
Fresh tea	7.5 t truck	7-14
Large tea bags	7.5 truck	200-300
Pallets	7.5 truck	50
Slip sheets	7.5 truck	85
Tea (to Mombasa)	40 t truck	720
Tea (to UK)	Shipping	11,200
Tea (to Manchester)	40 t truck	400
Tea (to retailer)	22t truck	300
Total		**~36,800**

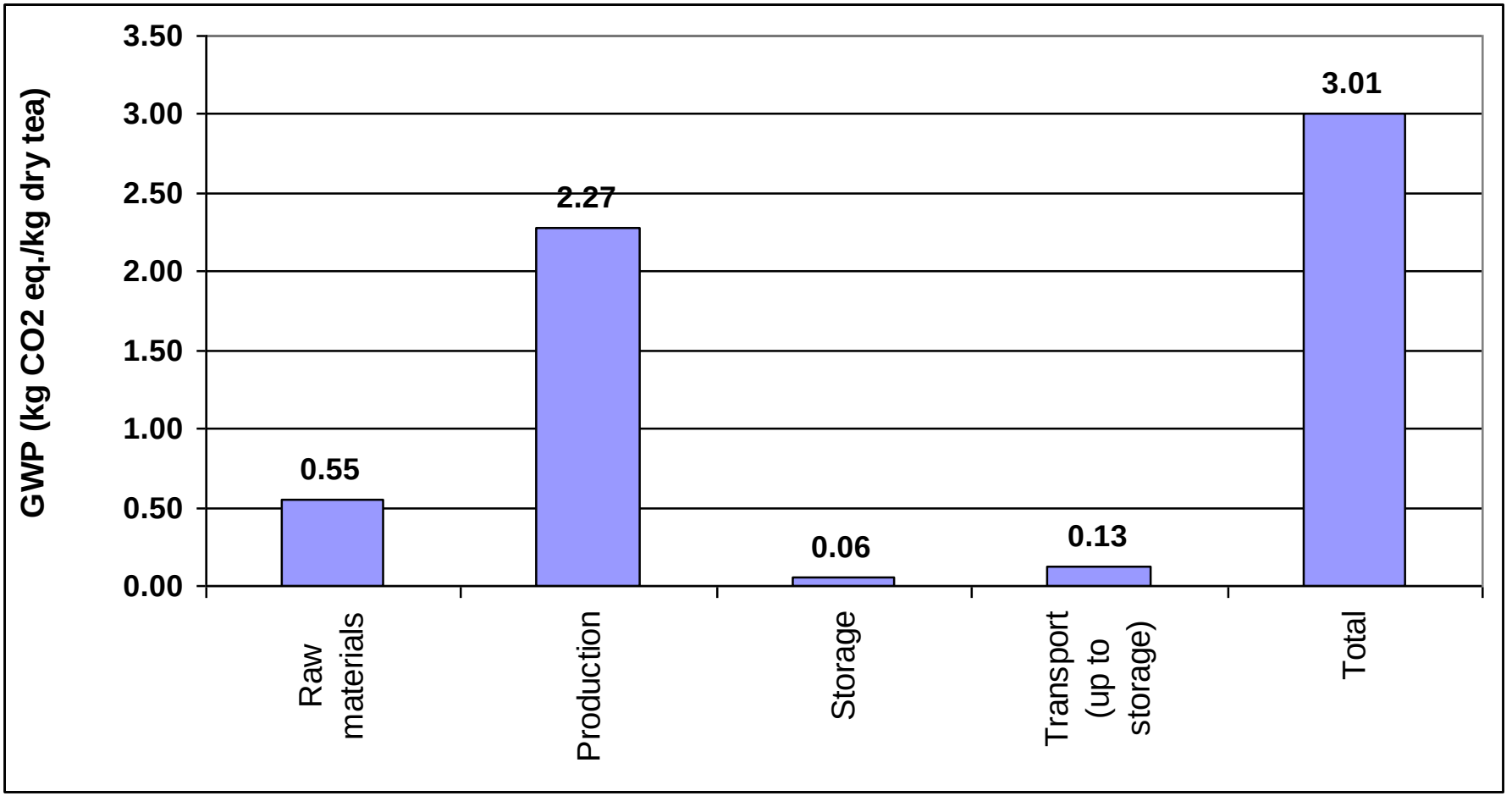
Data and assumptions: Waste

- All waste assumed landfilled except for paper/cardboard packaging disposed off in the UK
  - 80% recycled (UK average)
  - system credited for recycling

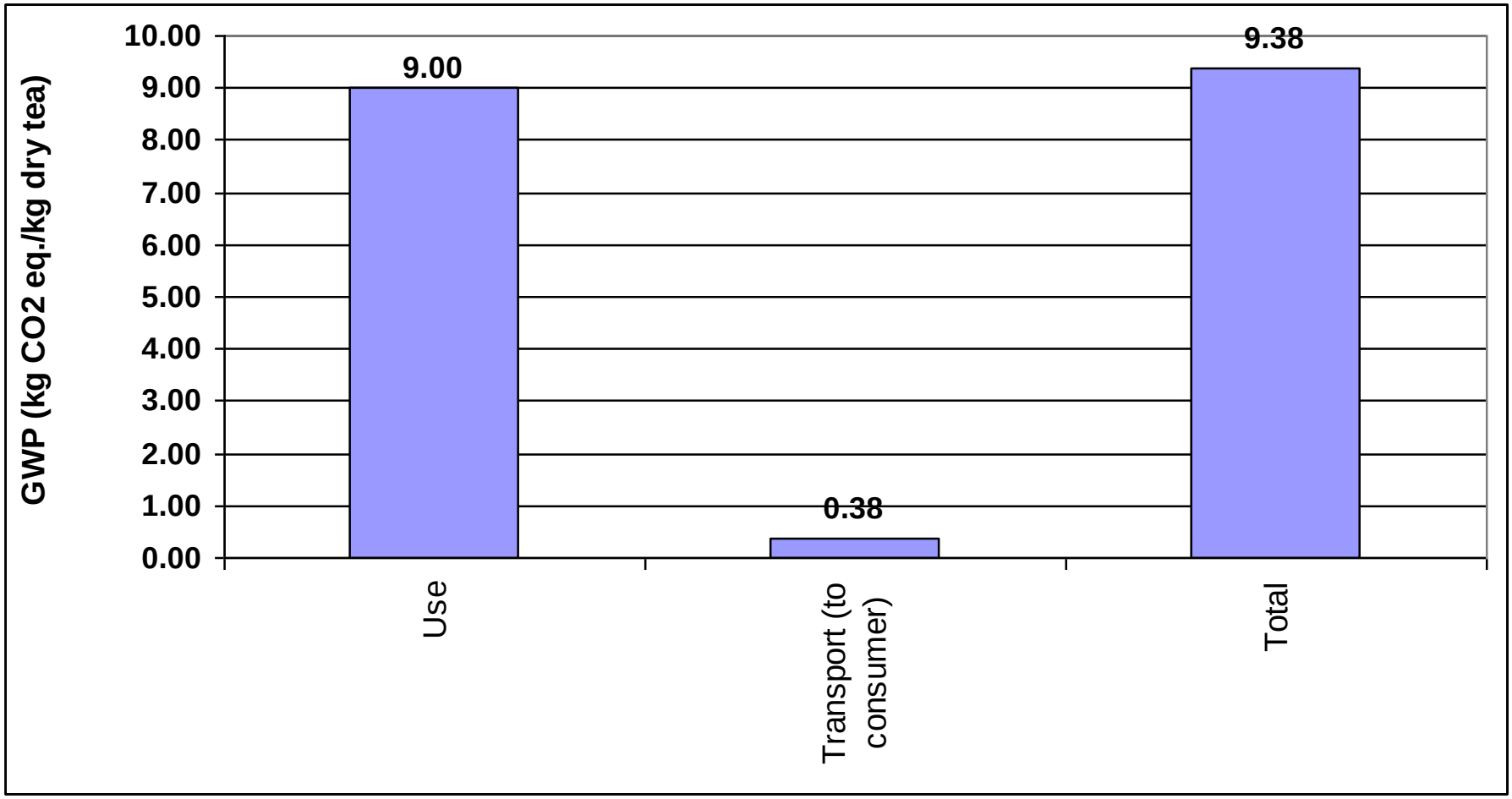
Carbon footprint of Kenyan electricity



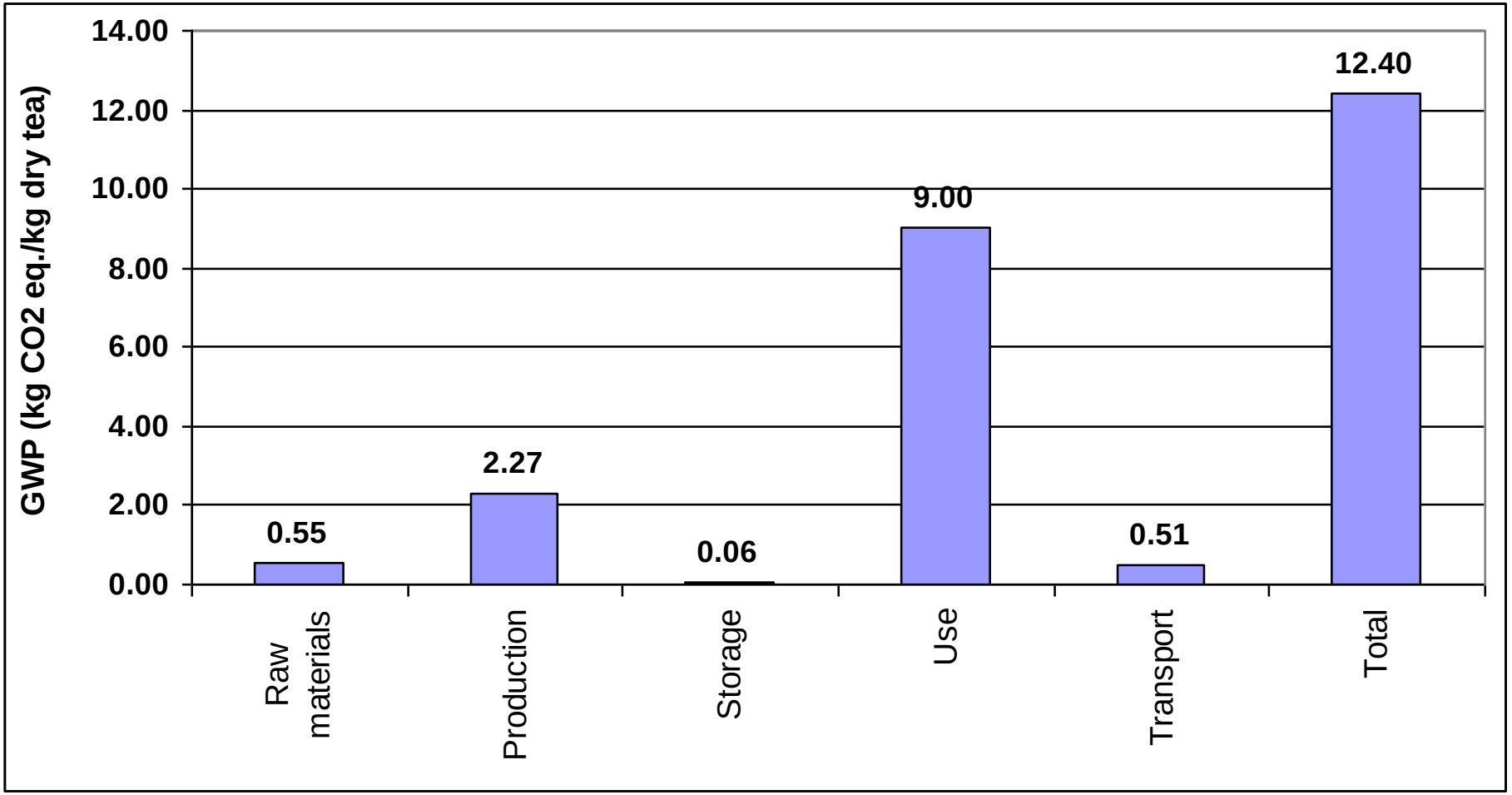
Carbon footprint of 1 tea of dry tea: ‘Cradle to gate’



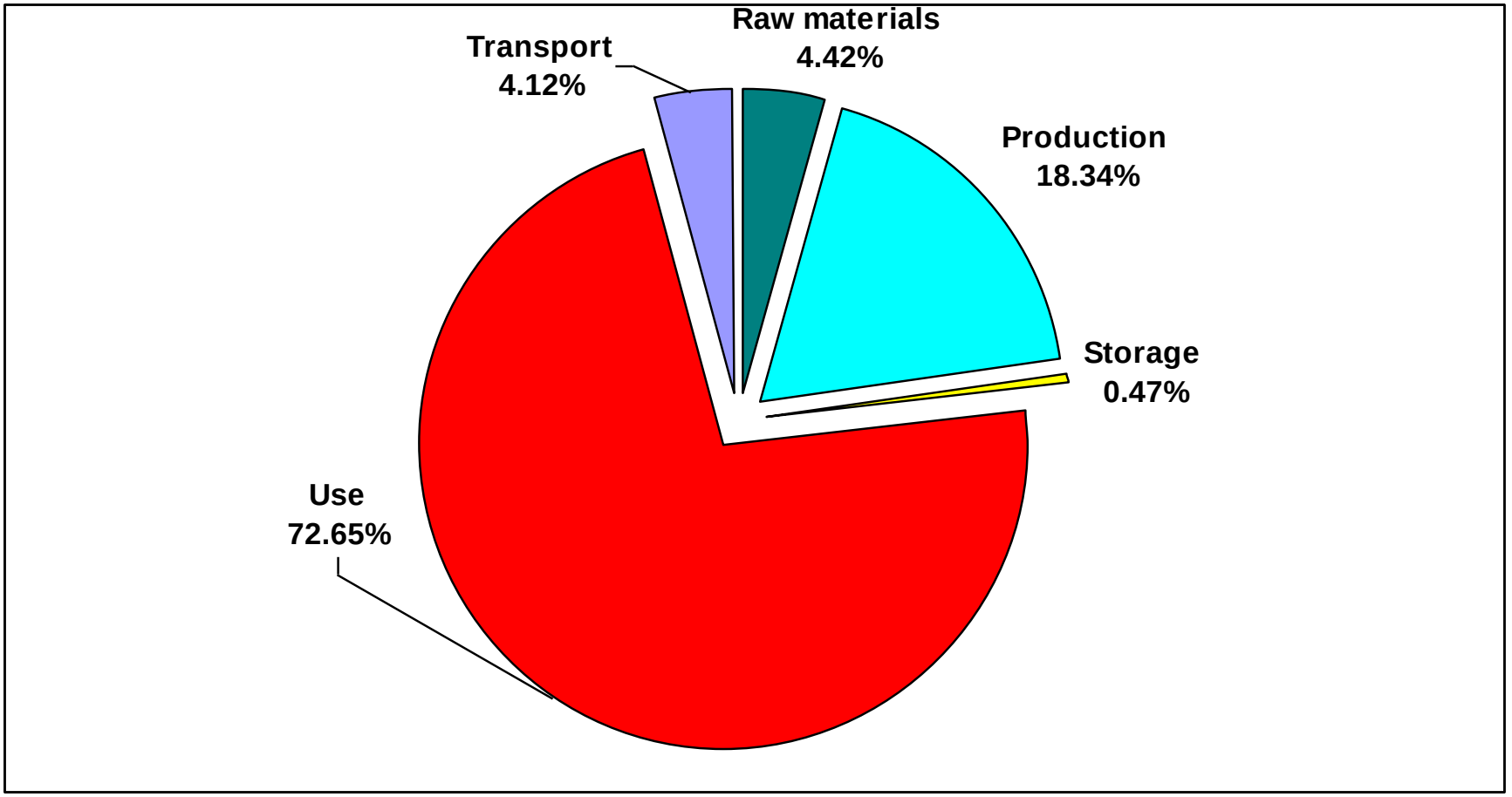
Carbon footprint of 1 tea of dry tea: ‘Gate to consumer’



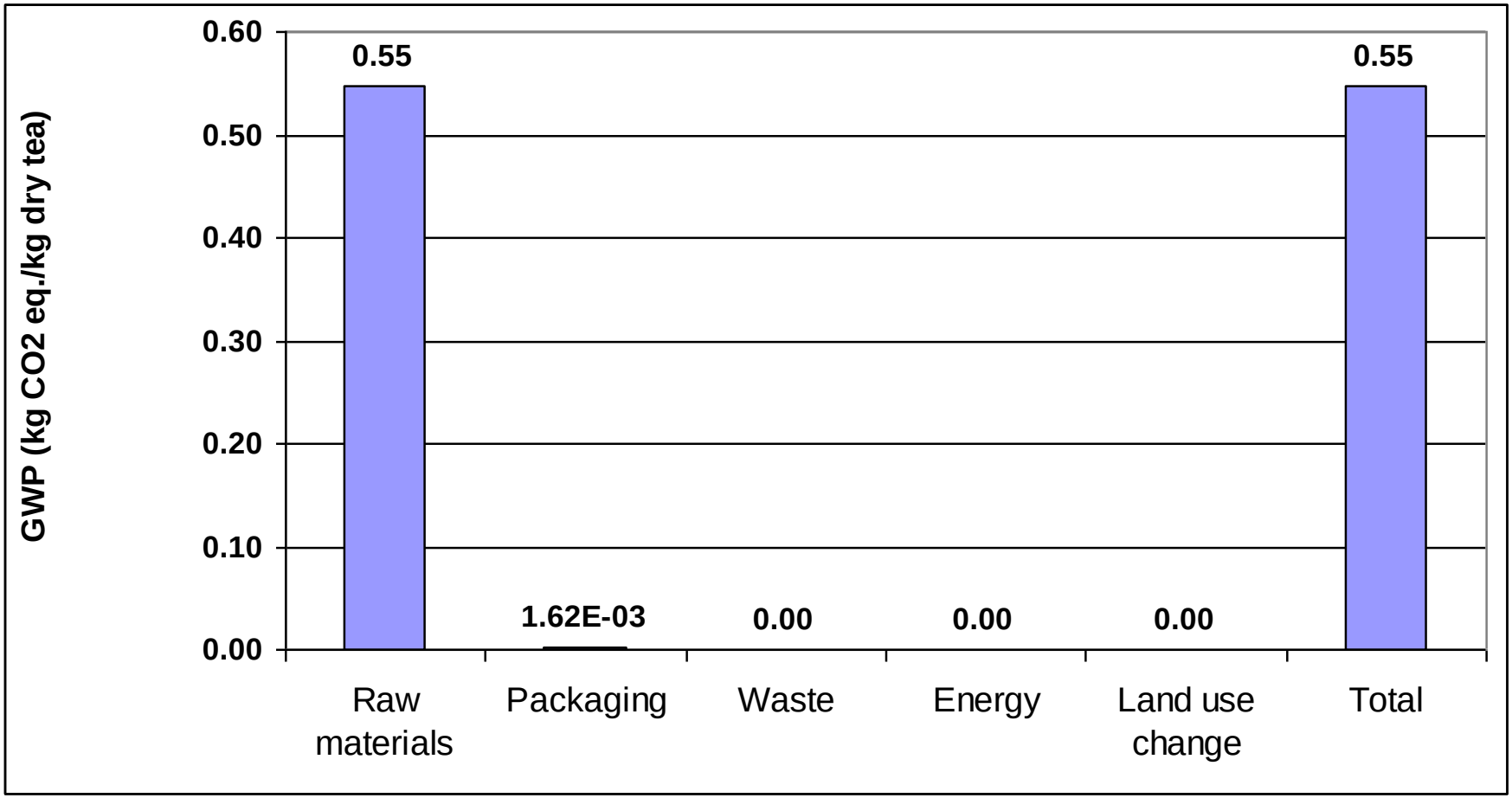
Carbon footprint of 1 kg of dry tea: ‘Cradle to grave’



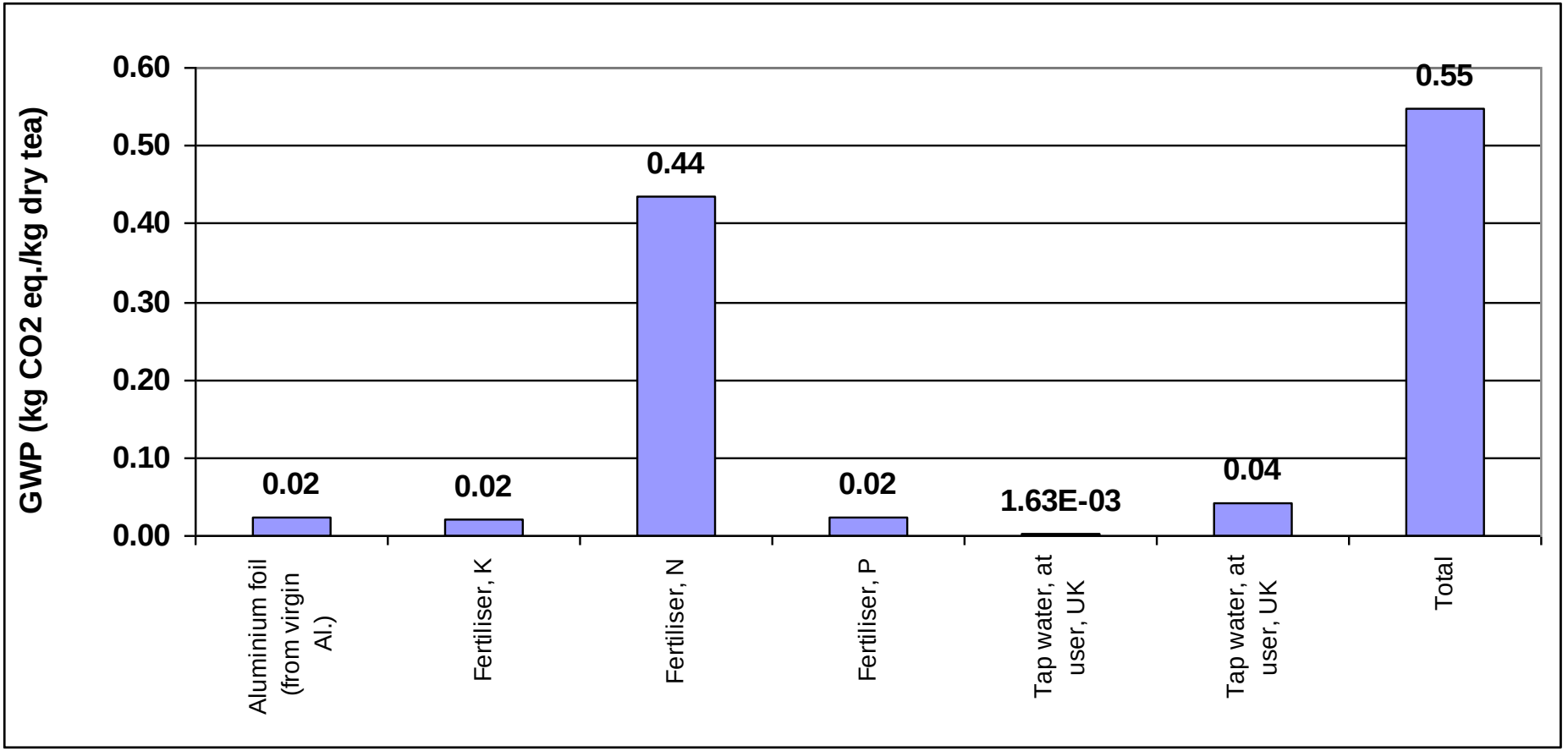
Contribution to the total carbon footprint



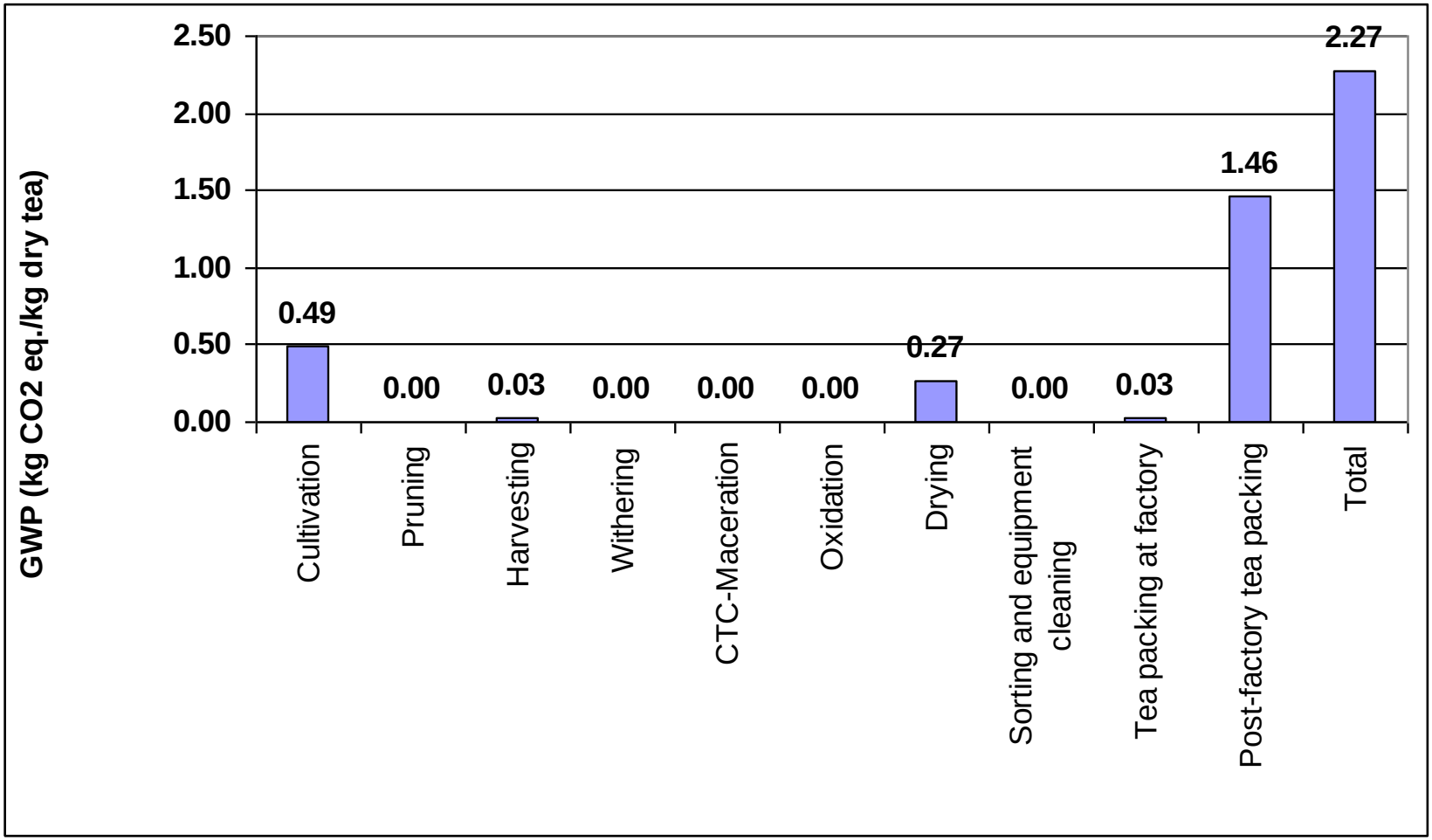
Contribution analysis: Carbon footprint of raw materials



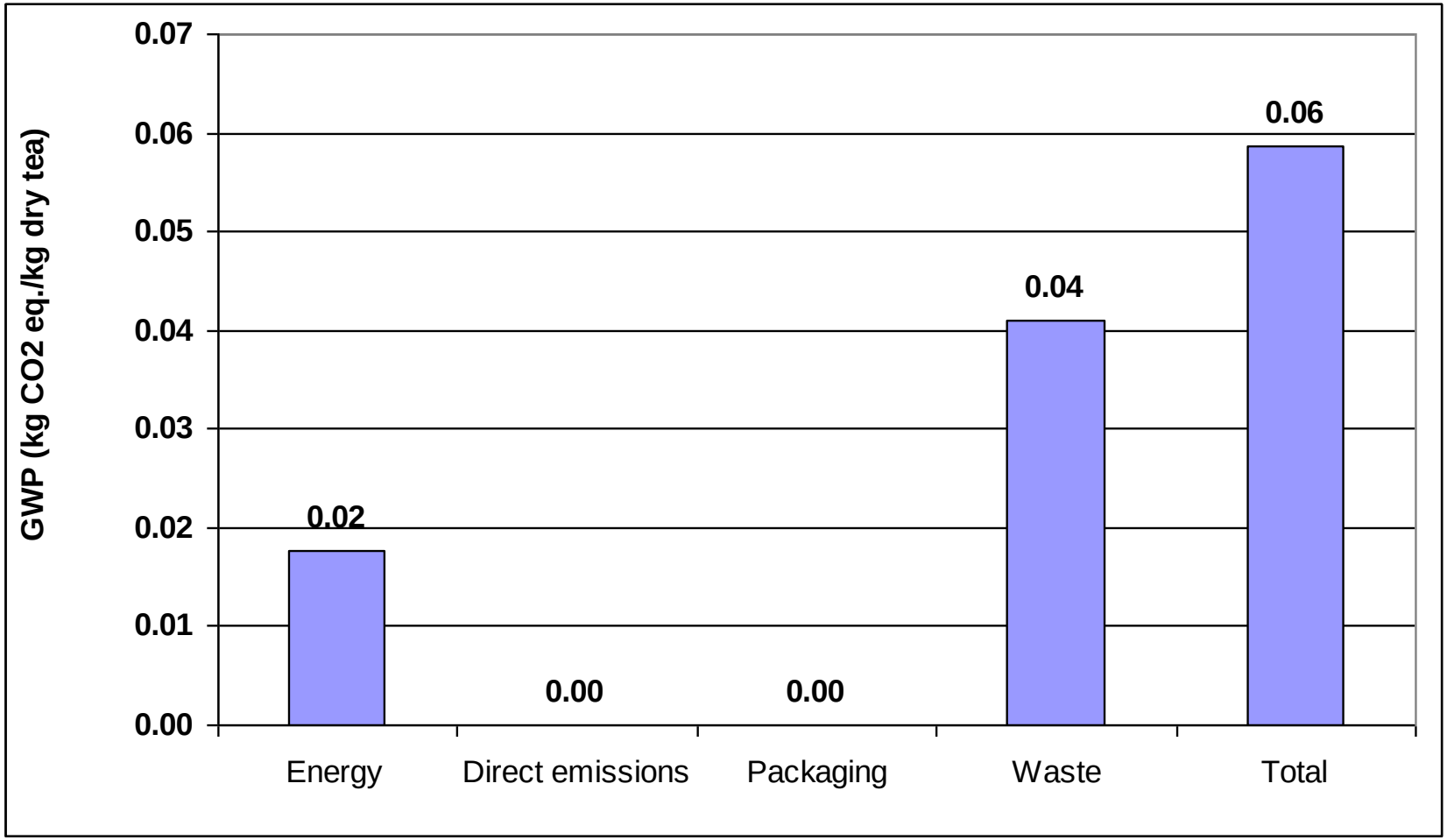
Contribution analysis: Carbon footprint of raw materials



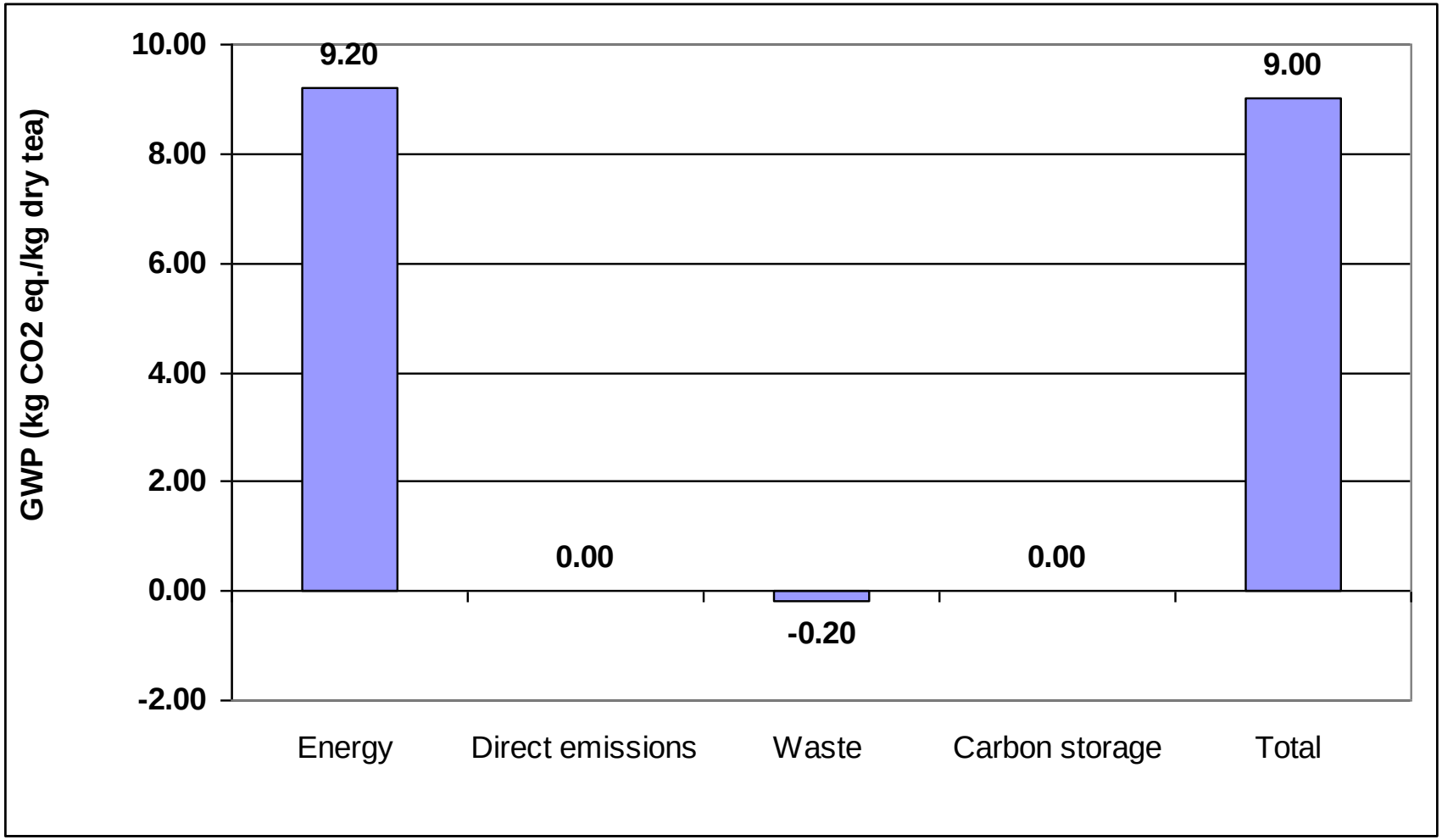
Contribution analysis: Carbon footprint of production and packaging



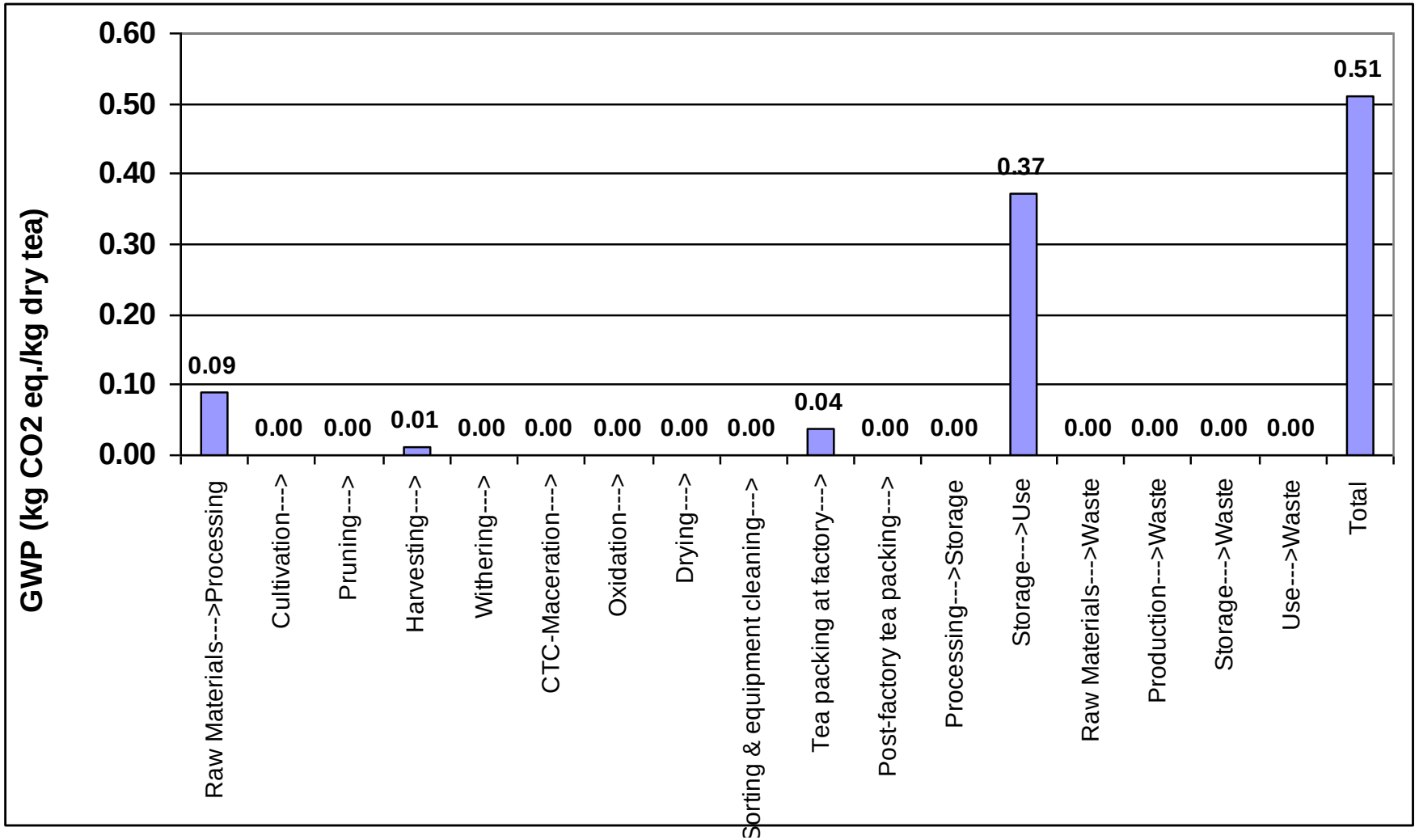
Contribution analysis: Carbon footprint of storage in Mombasa



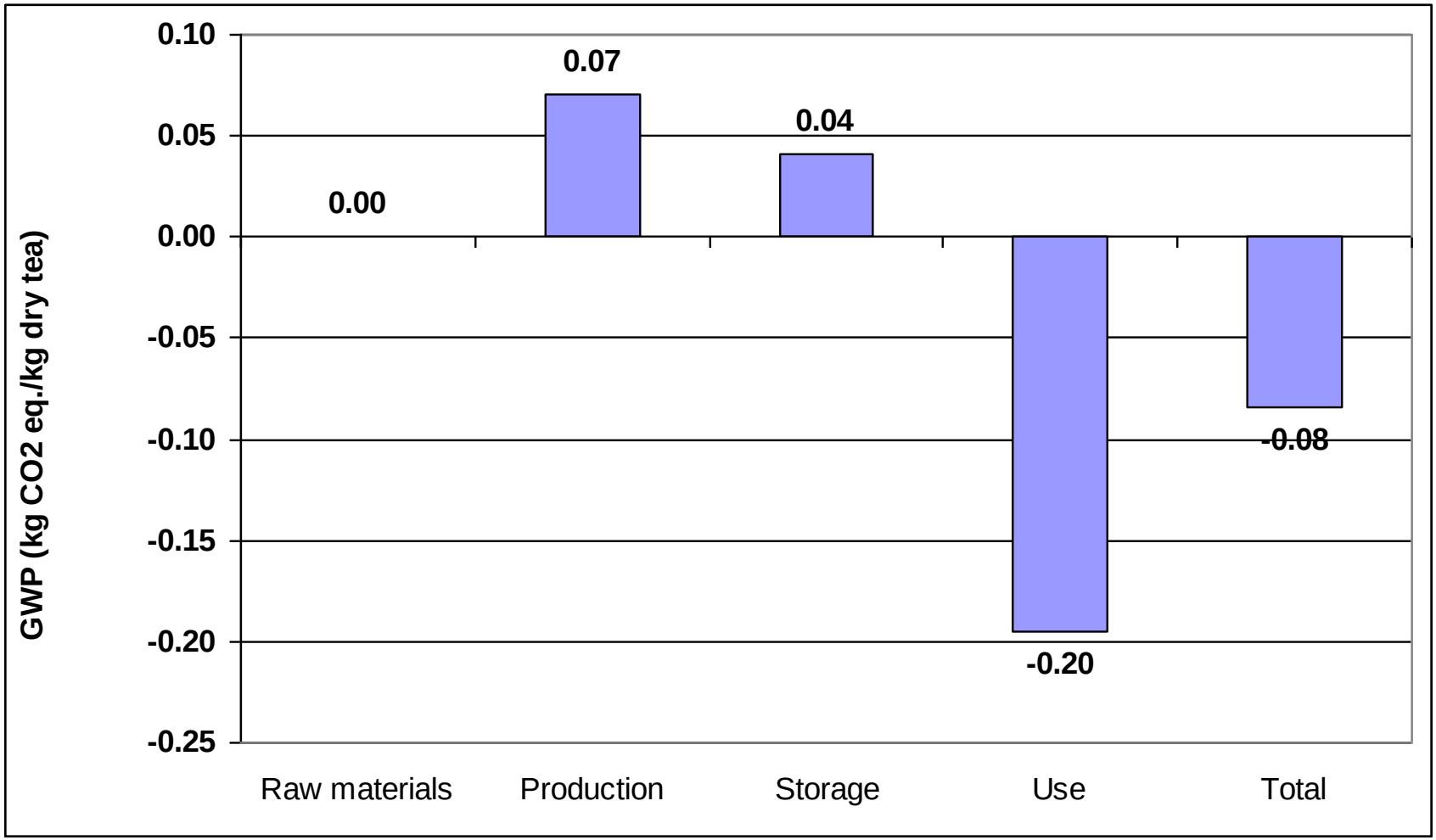
Contribution analysis: Carbon footprint of use



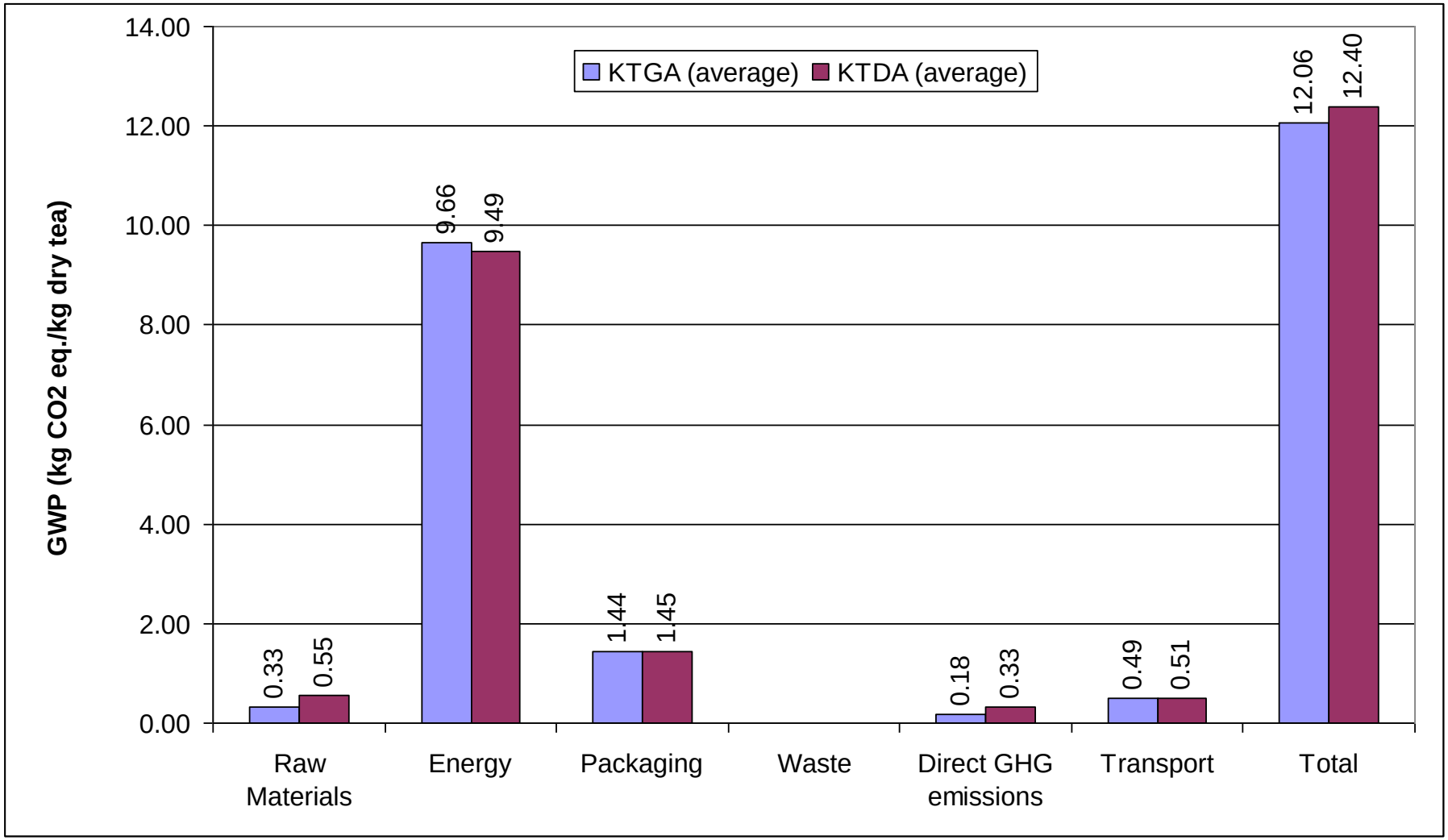
Contribution analysis: Carbon footprint of transport



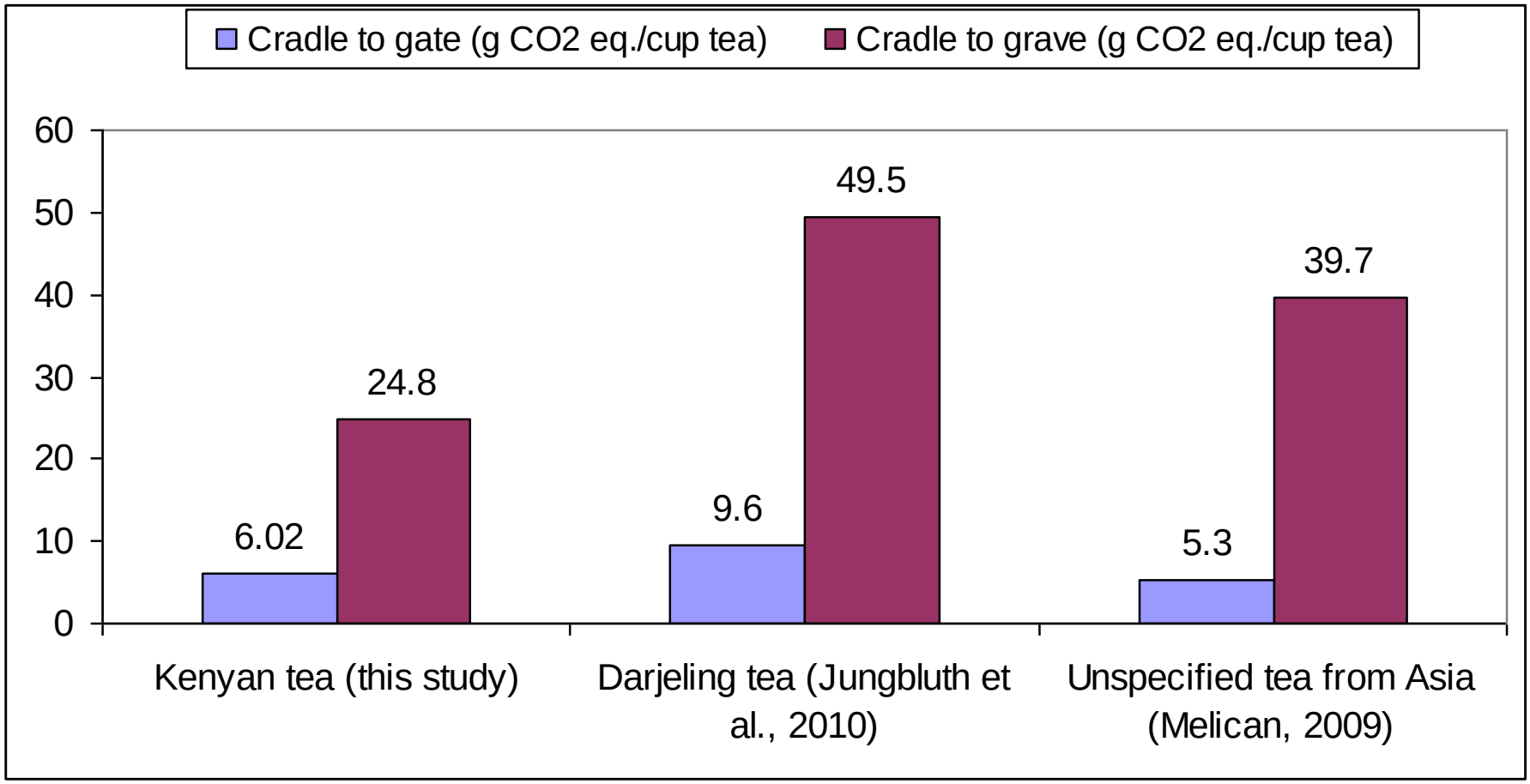
Contribution analysis: Carbon footprint of waste



Comparison of small and large-scale tea production



Comparison of results with literature



Conclusions

- Carbon footprint of tea
  - from ‘cradle to gate’: ~3 kg CO_2 eq./kg dry tea
  - From ‘cradle to grave’: ~12 CO_2 eq./kg dry tea
- Main contributors:
  - Consumer (70%)
  - Production (20%)
  - Raw materials (4%)
  - Transport (4%)
- The results are sensitive to the assumptions for energy use in the consumption stage