ifeu – Institute for Energy and
Environmental Research Heidelberg

Food import versus regional production

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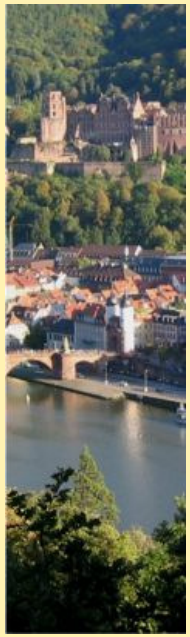
LCA Food 2010

Bari, September 24, 2010

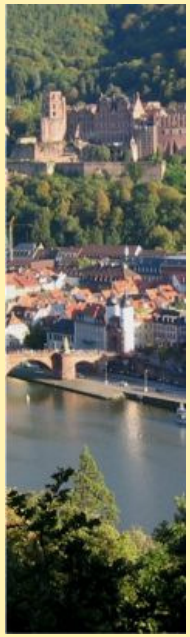
Who we are - What we do



IFEU - Institute for Energy and Environmental Research Heidelberg, since 1978

- Independent scientific research institute
- organised as a private non profit company with currently about 45 employees
- Research / consulting on environmental aspects
  - Energy
  - Mobility
  - Food and biomass use
  - …

Who we are - What we do

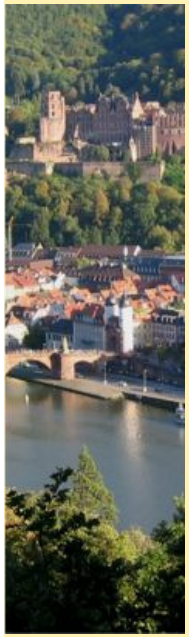


IFEU - Institute for Energy and Environmental Research Heidelberg, since 1978

Our clients (on biomass studies)

- World Bank
- UNEP, GTZ, etc.
- European Commission
- National and regional Ministries
- Associations (industrial, Life Cycle Analyses)
- Local authorities
- NGOs
- Companies
- Foundations

Who we are - What we do



IFEU focuses regarding the topic of food and biomass

- **Research / consulting on environmental aspects of**
  - **biofuels + biomass-based electricity and heat**
  - **cultivation systems (e.g. conventional and organic)**
  - **food production and consumption:**
    - **Product LCAs**
    - **Supply chains and consumption patterns:**
      - **Regional food**
      - **Meat consumption**
      - **…**

IFEU food and biomass team

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Background

The percentage of imported food has significantly increased during the last decades.

Regional produced food is considered by some to be particularly environmentally friendly, especially regarding energy demand and climate relevant emissions.

regional food group

LCA:
Regional versus imported food commodities

Financed by:
German Ministry for Nutrition, Agriculture and Consumer Protection

Scope

Impact categories:

- cumulative primary energy demand of non-renewable sources (MJ)
- greenhouse gas emissions (CO_2-equivalents)

Six analyzed commodities:

Apple (as fruit)

Lettuce (as vegetable)

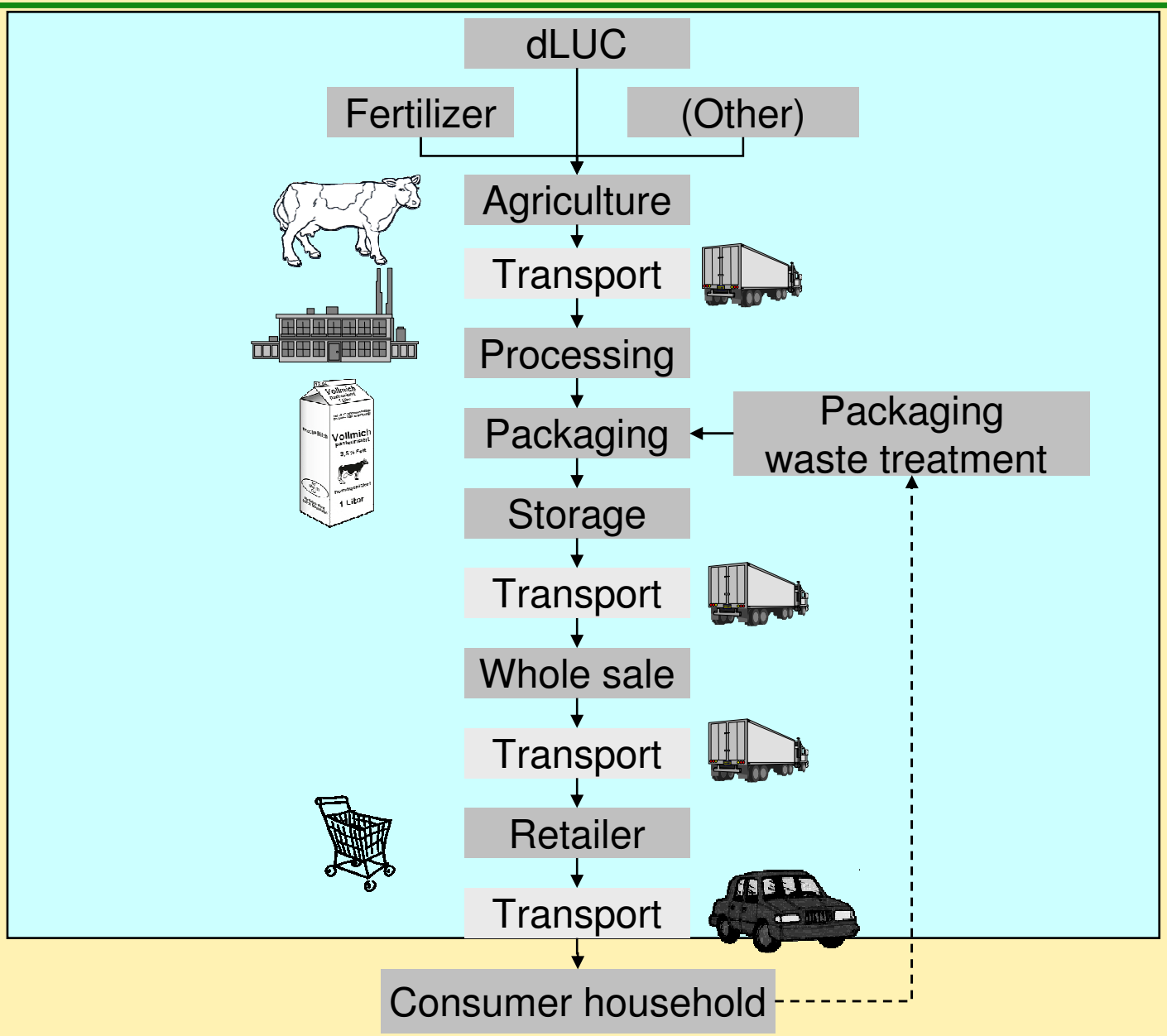
Beef (as meat product)

Bread (as processed stable food)

Beer (as beverage)

Milk (as dairy product)

System boundaries

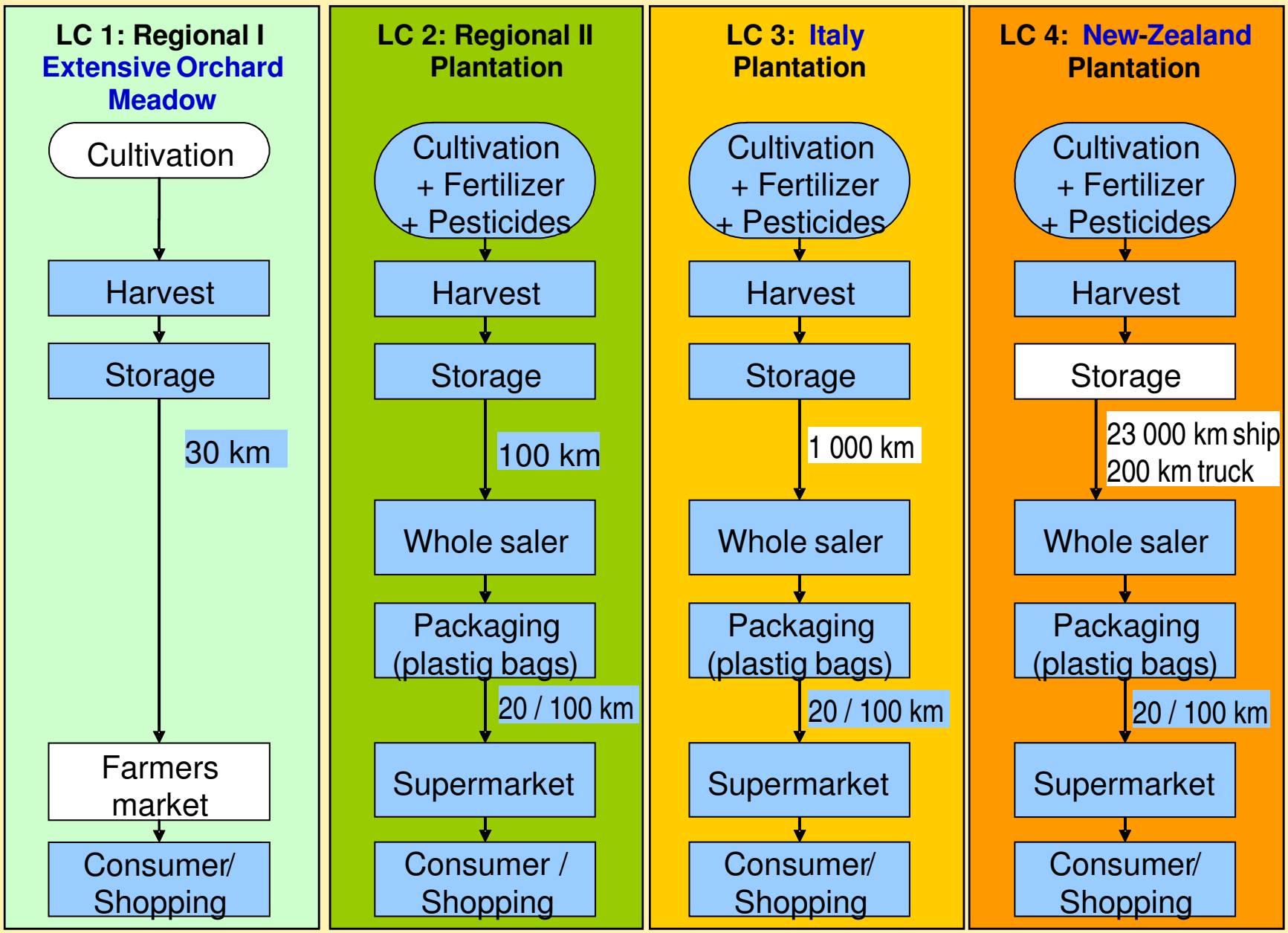


Data

- Typical production processes and supply chains for Germany
- Data sources:
  - IFEU Database + IFEU research (associations, companies etc.)
  - Other data bases: Ecoinvent
  - Others sources (journals, KTBL)

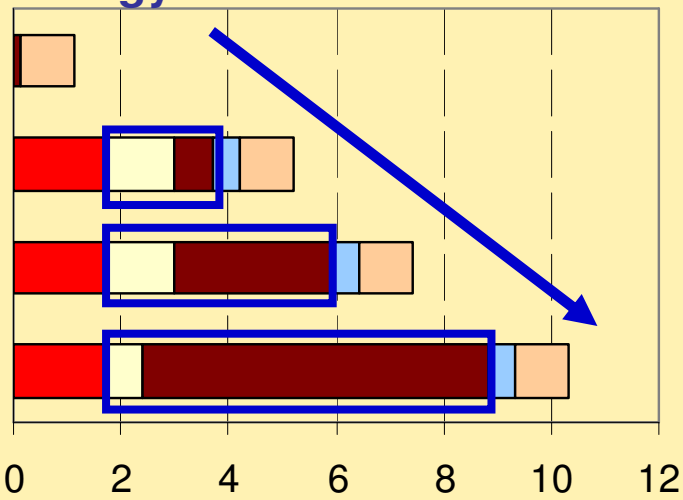
Apples

Apple Life Cycles



Apples: Basic Scenarios

Energy demand



LC 1: Extensive Orchard meadow - Regional

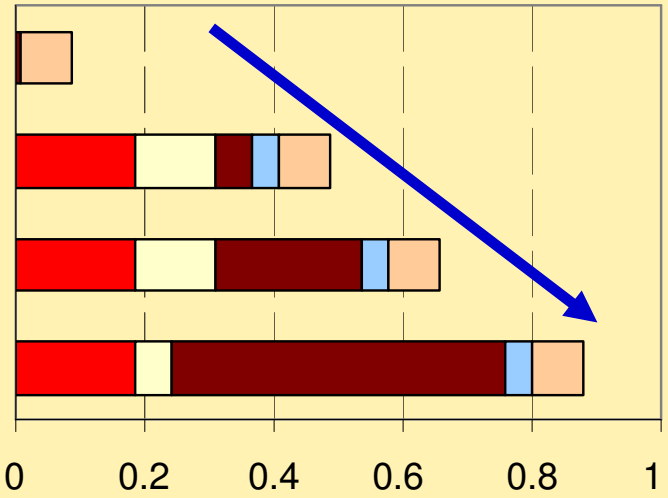
LC 2: Plantation - Regional

LC 3: Plantation - Italy

LC 4: Plantation - New Zealand

MJ PE / 2 kg Apples

GHG emissions



LC 1: Extensive Orchard meadow - Regional

LC 2: Plantation - Regional

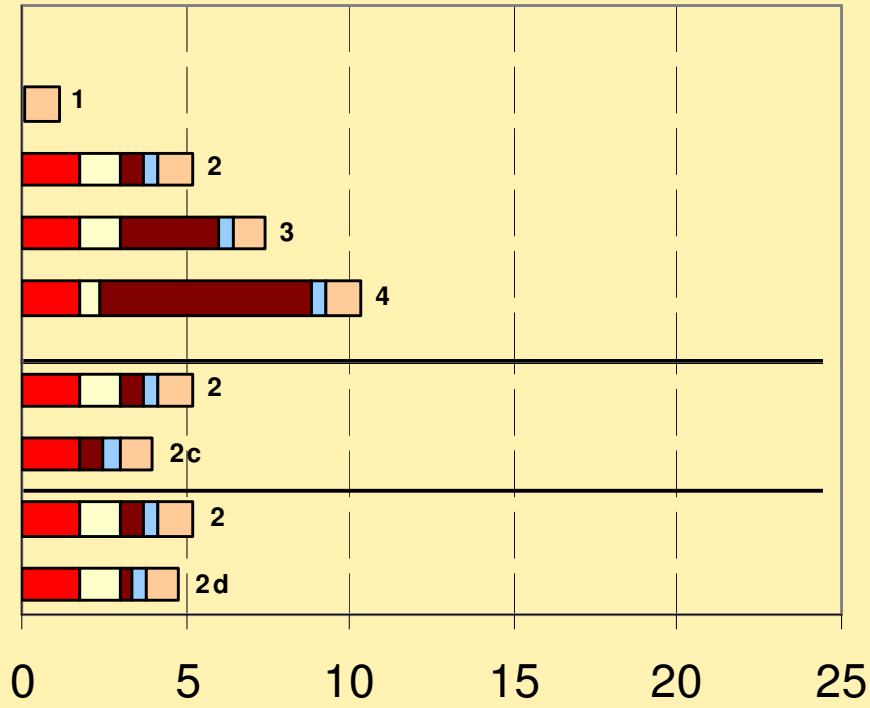
LC 3: Plantation - Italy

LC 4: Plantation - New Zealand

kg CO_2-eq / 2 kg Apples

Cultivation | Storage and cooling | Transportation | Packaging | Shopping

Apples: Sensitivity Scenarios



Energy demand

LC 1: Extensive Orchard meadow - Regional

LC 2: Plantation - Regional

LC 3: Plantation - Italy

LC 4: Plantation - New Zealand

LC 2: 6 month storage (standard)

LC 2: no storage

LC 2: long transport distances (standard)

LC 2: short transport distances

MJ PE / 2 kg Apples

Cultivation | Storage and cooling | Transportation | Packaging | Shopping

Lettuce

Lettuce Life Cycles

LC 1: Regional I
Summer, Farmersmarket

- Field
- Harvesting
- 30 km
- Farmers market
- Consumer / Shopping

LC 2: Regional II
Summer, Retailer

- Field
- Harvesting
- Packaging: plastic foil
- 200 km
- Wholesale
- Cooling
- 20 km
- Supermarket
- Consumer / Shopping

LC 3: Regional III
Winter, Retailer

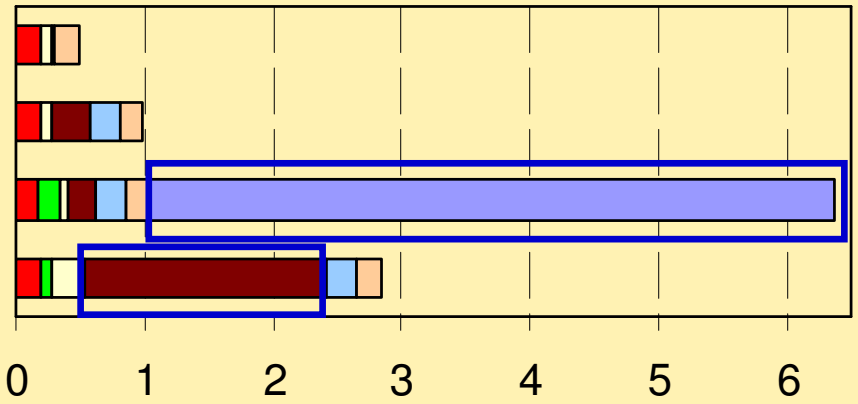
- Greenhouse
- Heating
- Harvesting
- Packaging: Plastic foil
- 200 km
- Wholesale
- Cooling
- 20 km
- Supermarket
- Consumer / Shopping

LC 4: Spain
Winter, Retailer

- Foil tunnels
- Harvesting
- Packaging: Plastic foil
- 2000 km
- Wholesale
- Cooling
- 20 km
- Supermarket
- Consumer / Shopping

Lettuce: Basic Scenarios

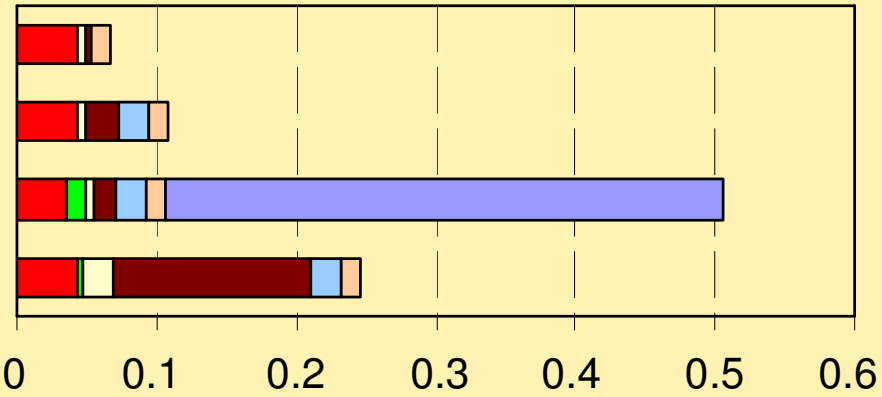
Energy demand



LC 1: Regional - Summer - Farmers market
LC 2: Regional - Summer - Retailer
LC 3: Regional - Winter - Retailer
LC 4: Spain

MJ PE / head of lettuce

GHG emissions



LC 1: Regional - Summer - Farmers market
LC 2: Regional - Summer - Retailer
LC 3: Regional - Winter - Retailer
LC 4: Spain

kg CO_2-eq / head of lettuce

- Cultivation
- Cooling
- Packaging
- Heating
- Material for greenhouses
- Transportations
- Shopping

Conclusions Apples and Lettuce

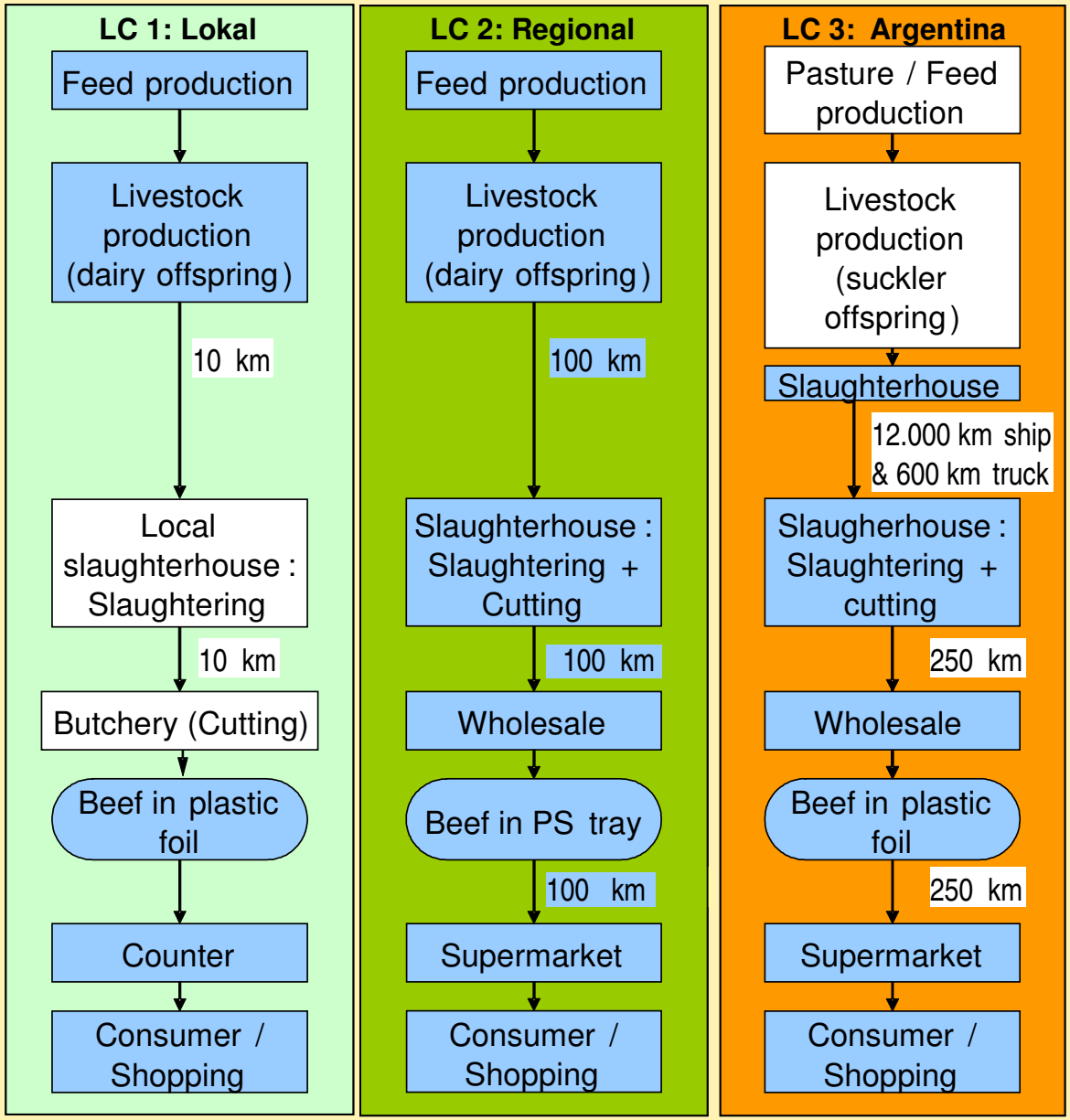
- Regional and seasonal production is advantageous if the production systems are similar
- Regional but not seasonal products
  - Tend to be advantageous even if cooled storage over 6 month is needed
  - Tend to be disadvantageous if heating is needed

Recommendation

regional *and* seasonal

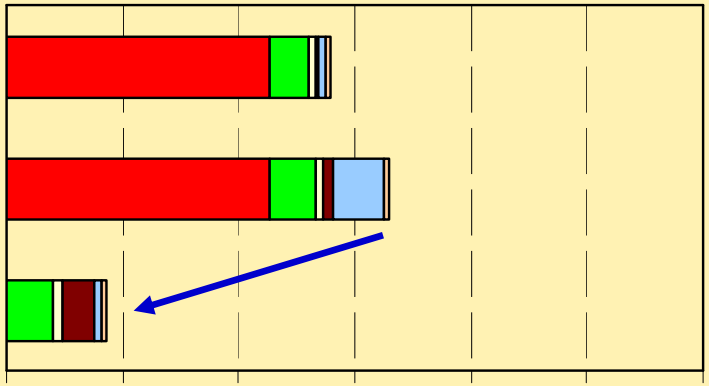
Beef

Beef Life Cycles



Beef: Basic Scenarios

Energy demand



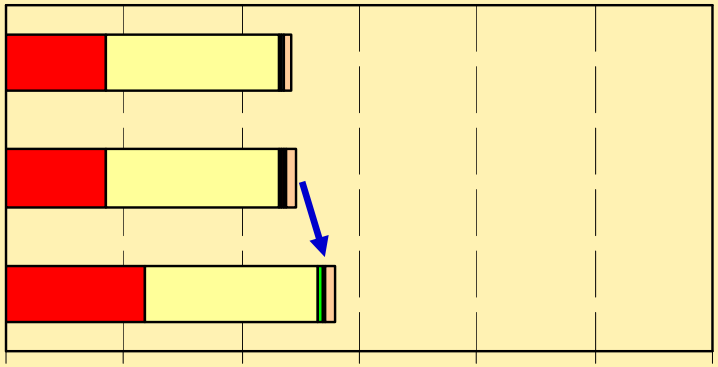
LC 1: Local, dairy offspring, butchery

LC 3: Regional, dairy offspring, supermarket (packaging tray)

LC 4: Argentina, suckler cow offspring

≠

GHG emissions



LC 1: Local, dairy offspring, butchery

LC 3: Regional, dairy offspring, supermarket (packaging tray)

LC 4: Argentina, suckler cow offspring

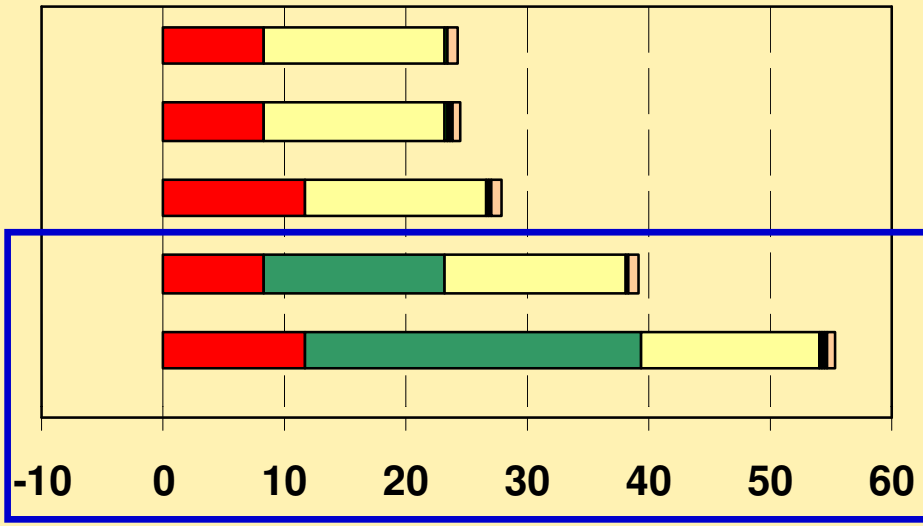
Apple, lettuce: < 0.5 kg!

Land use chage | Breeding | Enteric fermentation (Methan) | Transports

Butchering | Cooling | Packaging | Shopping

Beef: Sensitivity Scenarios

GHG emissions



LC 1: Local, dairy offspring, butchery

LC 3: Regional, dairy offspring, supermarket

LC 4: Argentina, suckler cow offspring

LC 2 b: Land use change, Regional

LC 4 b: Land use change, Argentina

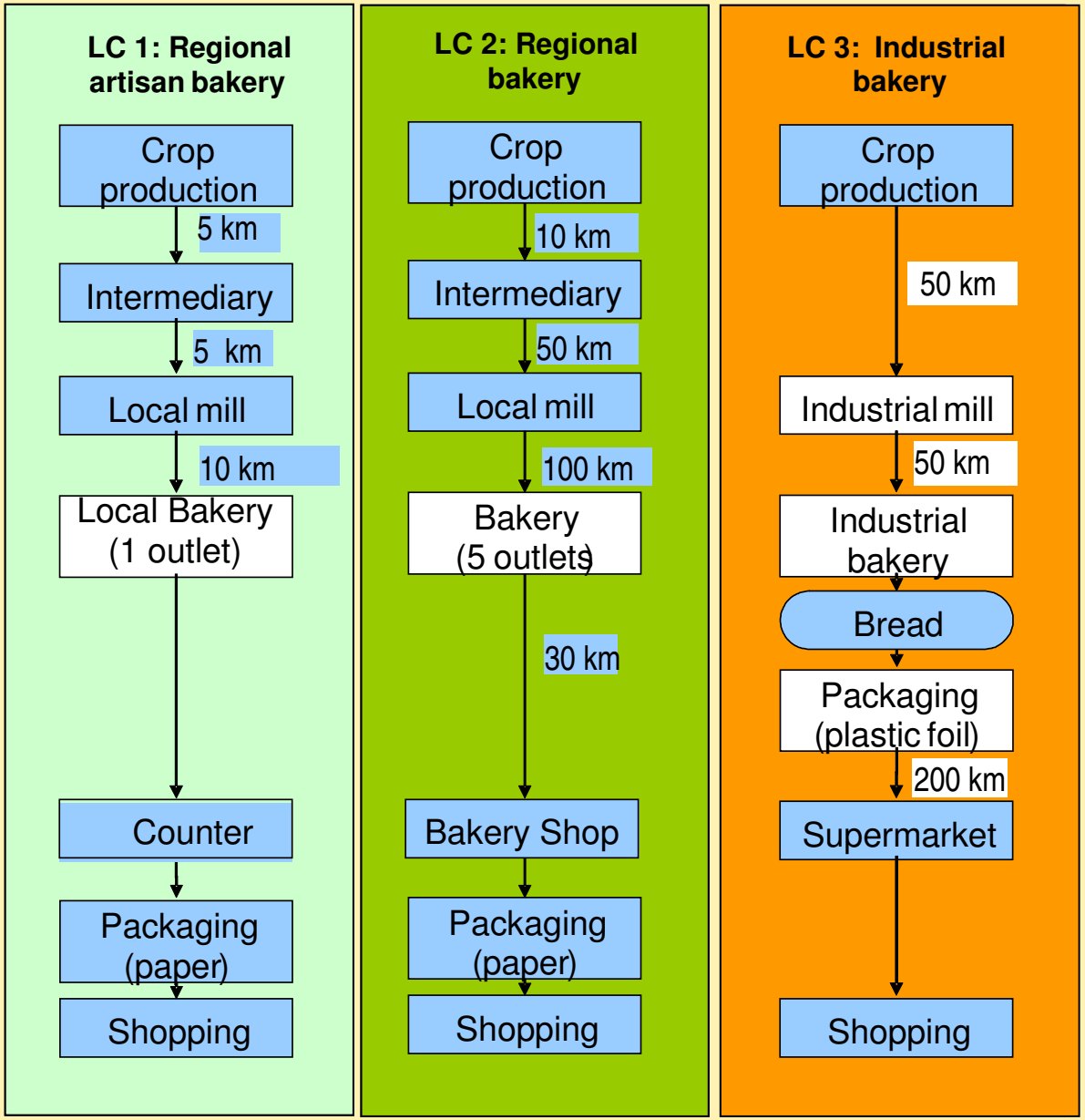
kg CO_2-eq / kg beef

Conclusions Beef

- Regional production is advantageous with regard to GHG emissions but disadvantageous with regard to energy demand
- Advantages and disadvantages are more cause by differences in livestock production systems than by transport distances
- GHG Emissions per kg of beef are about 20 times higher compared to GHG emissions per kg of apples or lettuce

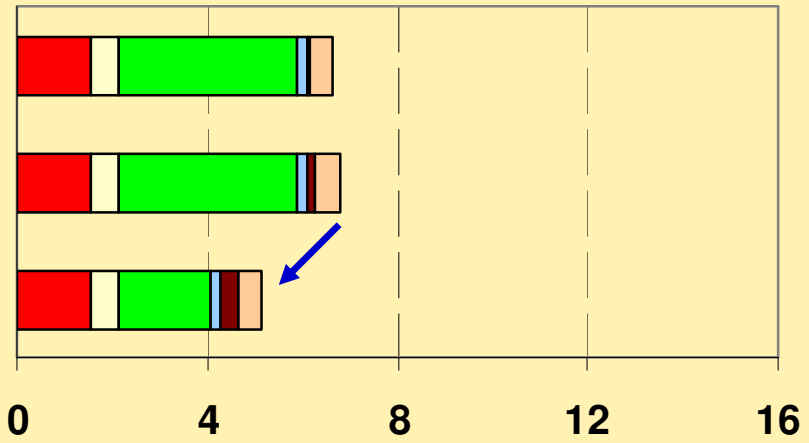
Bread

Bread Life Cycles



Bread: results

Energy demand



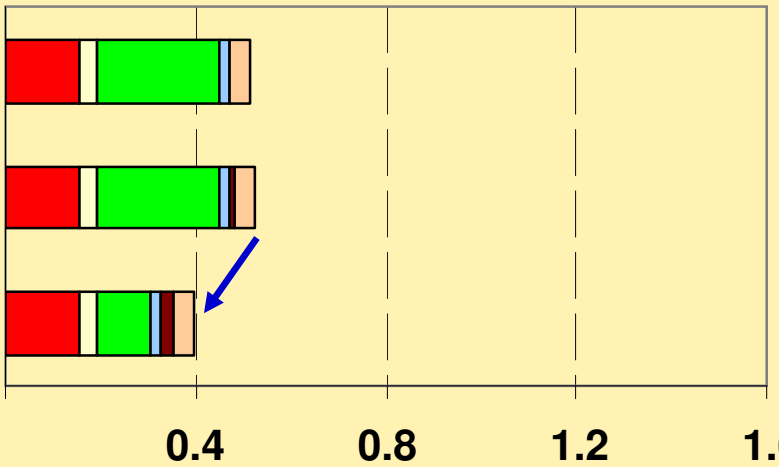
LC 1: Local, artisan backery

LC 2: Regional backery (5 shops)

LC 3: Industrial backery

MJ PE / kg bread

GHG emissions



LC 1: Local, artisan backery

LC 2: Regional backery (5 shops)

LC 3: Industrial backery

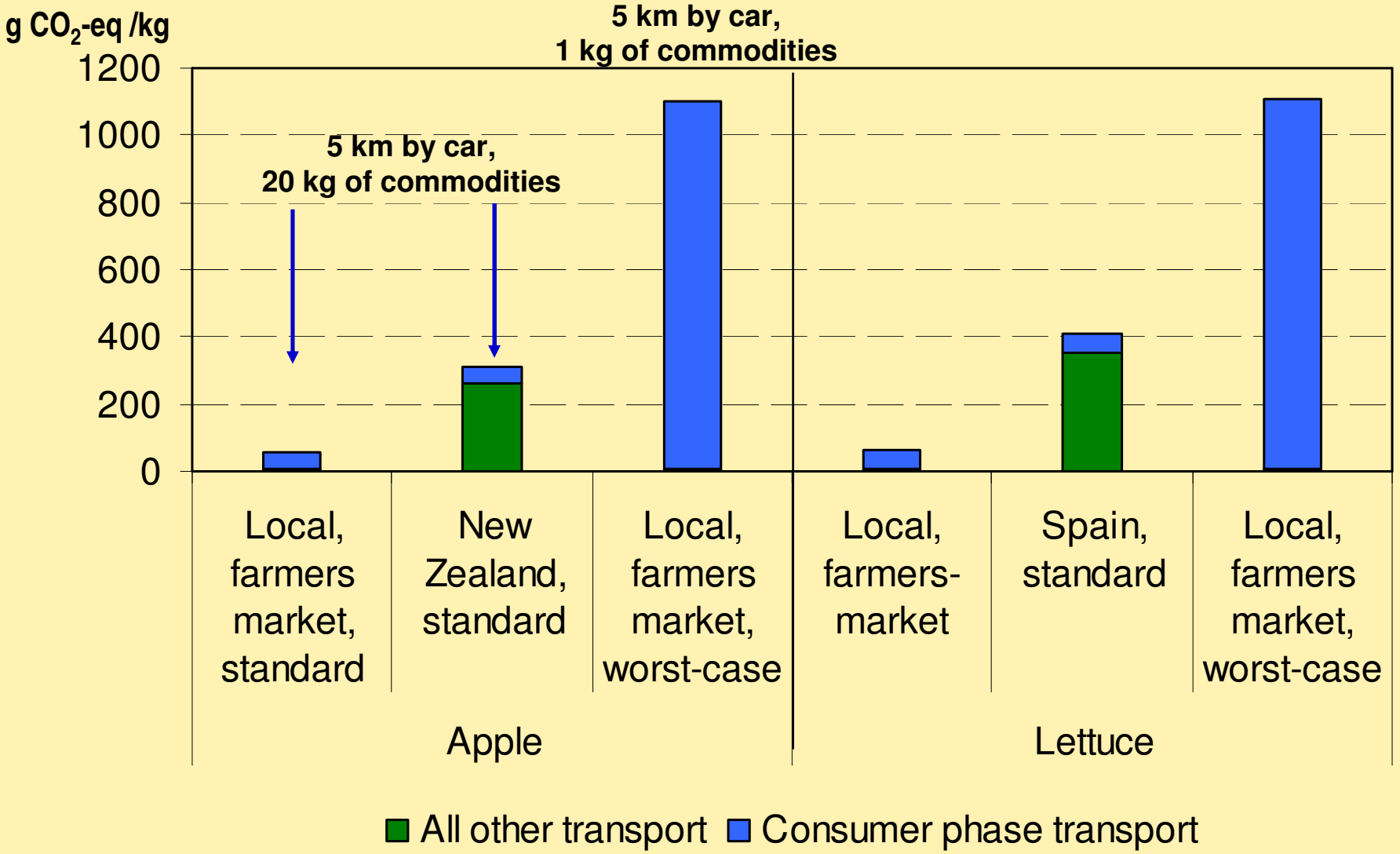
kg CO_2-eq / kg bread

Agriculture Milling Backing Packaging Transports Shopping

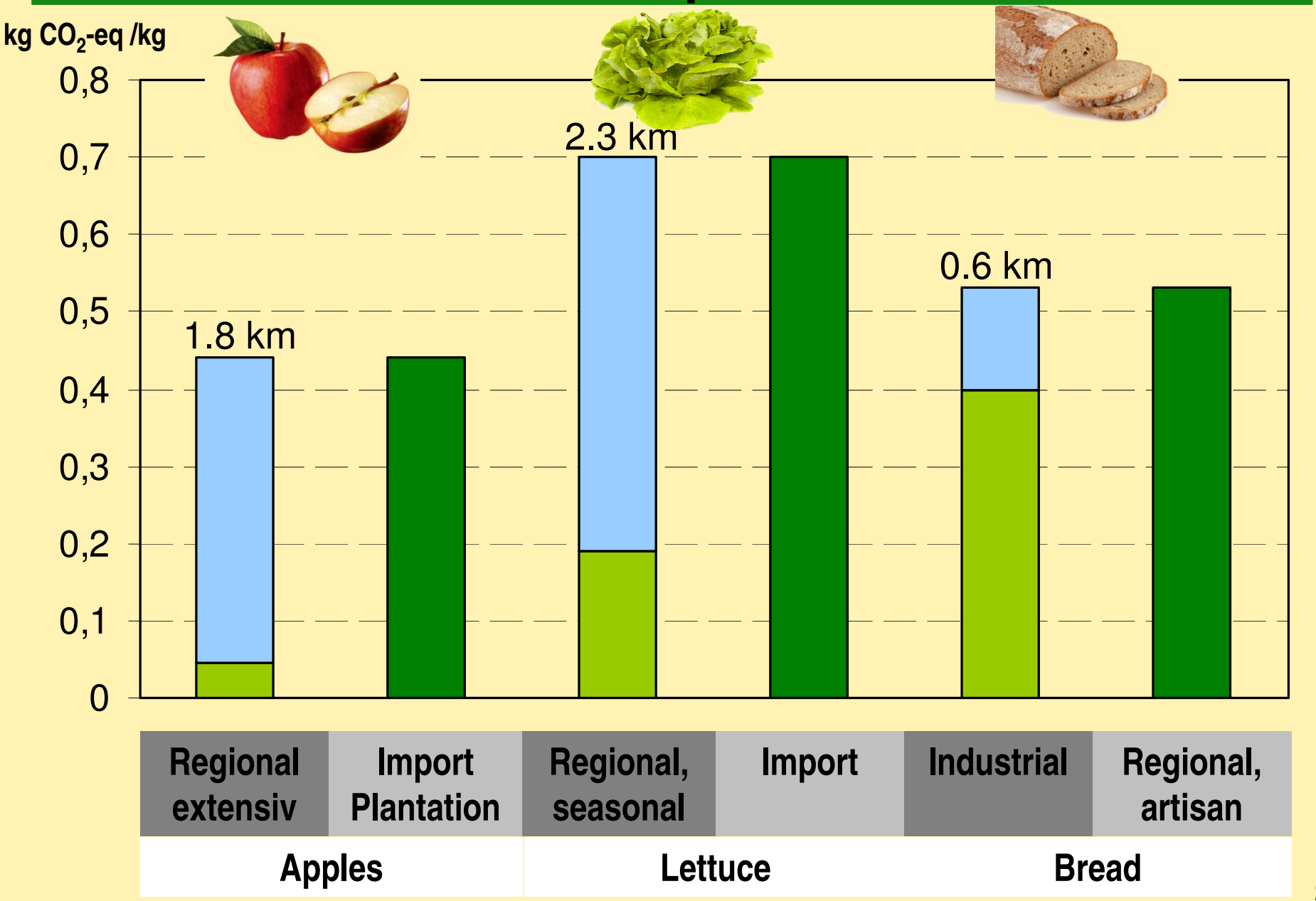
Consumer phase (shopping)

(Matty Symons © www.fotolia.de)

GHG emissions for shopping



Break even points for consumer transport distances



Further sensitive parameters

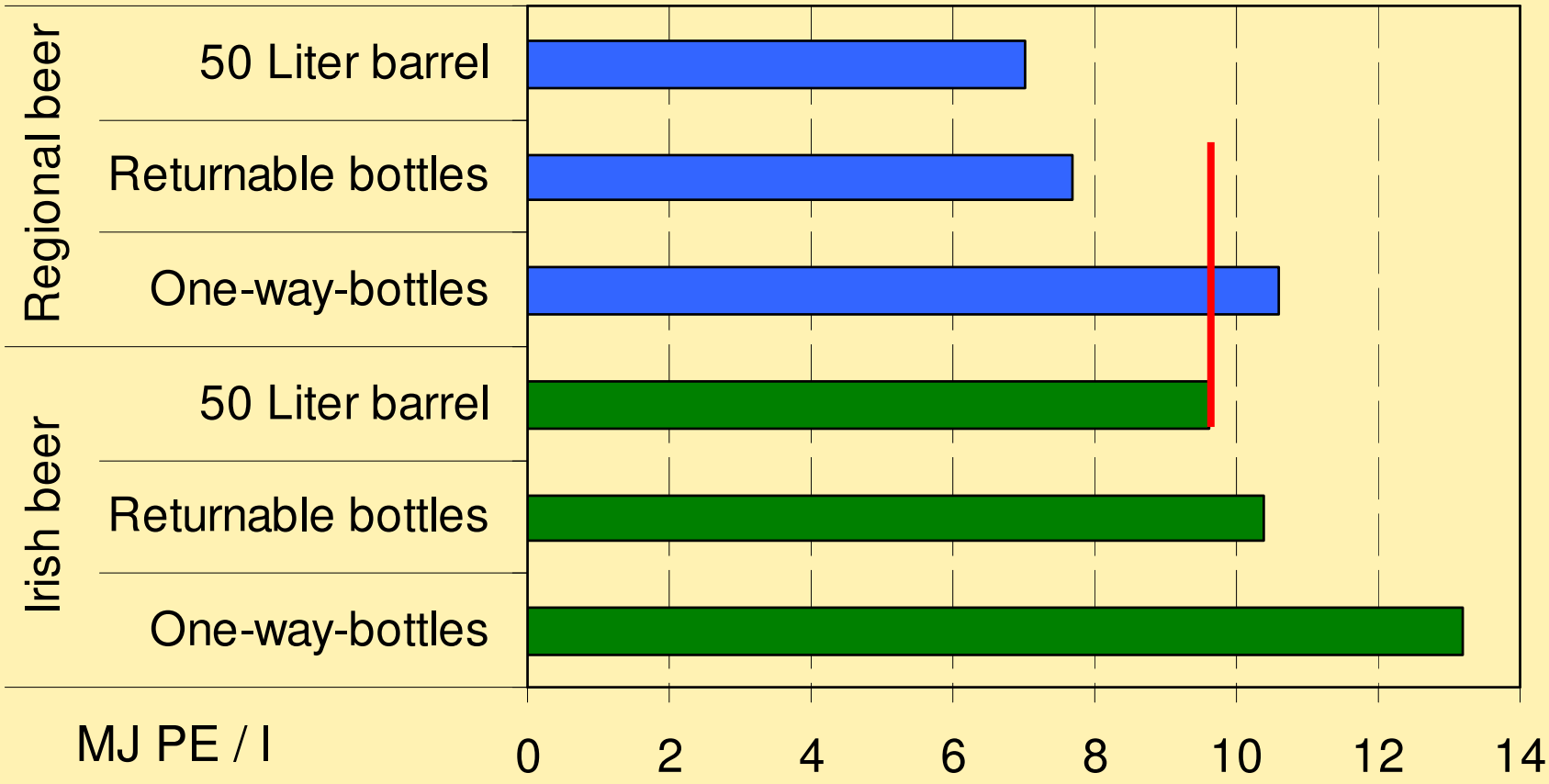
Supply chain losses

Setting: 0 % losses *post farm*

Reality: up to 50 % losses

→ If losses in the supply chains are different, results may change

Packaging


Regional beer
50 Liter barrel
Returnable bottles
One-way-bottles
Irish beer
50 Liter barrel
Returnable bottles
One-way-bottles
MJ PE / l
0
2
4
6
8
10
12
14

Conclusions

➡ Regional production is advantageous if the productions systems are the same.

If production systems differ:

For vegetables and fruits:  

Non-seasonal vegetables are most likely disadvantageous if **heating** is needed.

Non-seasonal vegetables/fruits can still be advantageous is only **cooled storage** is needed.

For beef: 

No recommendation (depending on production system, opposing effects on energy and climate)

Much higher GHG emission compared to vegetables/fruits(ca. factor 20)

For bread: 

Industrial bakery more energy efficient. But: Only for low consumer transport distances.

Conclusions

➡ If regional production is advantageous or not depends on the production system:

- Regional processing is often small-scale processing and can be less energy efficient
- Productions system for some products can be very different in different regions
- Seasonality: Regional, non-storable products are advantageous only as seasonal products
- Cooled storage can be more efficient than intercontinental supply of fresh commodities

Conclusions

- Recommendations to consumers:
  - Regional + seasonal
  - Don’t go shopping by car (or don’t drive extra kilometers)
  - Buy only what you can eat
- Recommendation for retailers:
  - Regional + seasonal ingredients
  - Optimization of food supply chain: Minimum losses
  - Optimization of processing (energy efficiency)
- High variance: Analysis of specific production chains necessary

Limitations

- Only energy and GHG emissions:

  Other environmental effects not regarded (e.g.):

  - Biodiversity
  - Eutrophication + Acidification

- Social implications not regarded

Thanks for your attention!

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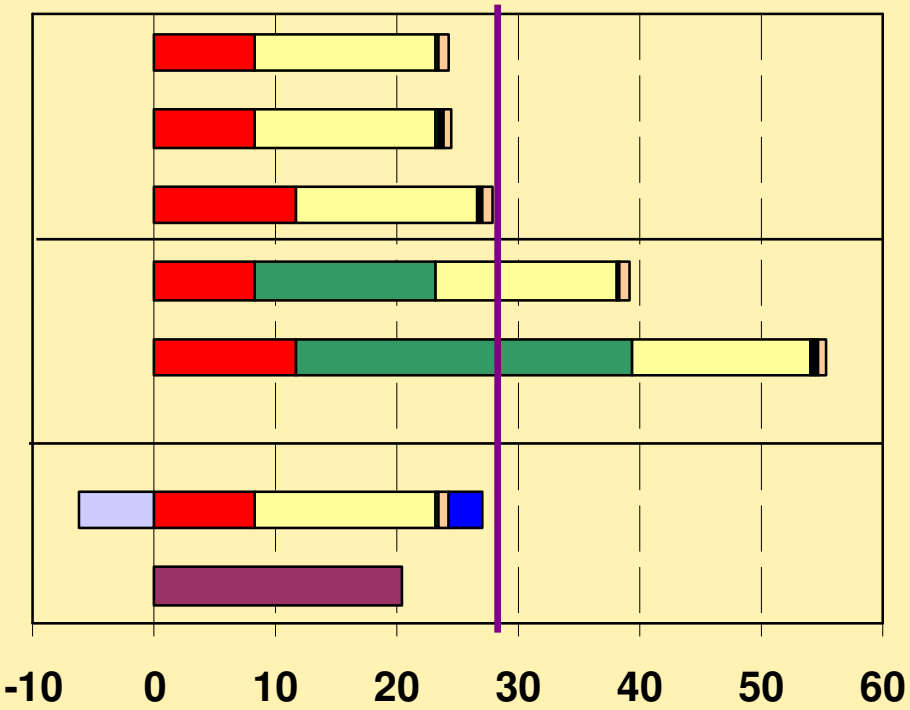
Beef: Sensitivity Scenarios

GHG emissions



LC 1: Local, dairy offspring, butchery

LC 3: Regional, dairy offspring, supermarket

LC 4: Argentina, suckler cow offspring

LC 2 b: Land use change, Regional

LC 4 b: Land use change, Argentina

LC 2 b: Biogas plant

LC 2 b: Biogas - Balance

kg CO2-eq / kg beef