

# Greenhouse gas emissions from UK food and drink consumption by systems LCA: current and possible futures



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**WWF**



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# Objectives

1. Produce 1<sup>st</sup> UK *consumption-orientated* GHG inventory of the UK food system using a life cycle perspective
2. Create & explore scenarios of production and consumption
3. 70% emissions reduction target possible from the supply chain by 2050?

# Inventory construction: quantities

- **Consumption**
  - Defra surveys: household and food service and industry stats
- Conversion matrix
- **Production** 110 Commodities (103 + 7)
  - Stats from FAO, Defra and industry
- **Food waste:** WRAP surveys

# Inventory: System model

## Supply Chain

- Primary production (UK & Overseas)
- Processing
- Distribution
- Retail & Service sector sales
- Home preparation
- Waste management

## Data

LCA, proxies (care)

Footprints

High level official,  
industry

Process models

## Land Use Change

# Quantities of top 30 commodities (without feed crops and net)

Commodity	Weight, kt		Commodity	Weight, kt
Milk	14,400		Bananas	660
Sugar cane	8,100		Onions	620
Potatoes	6,800		Maize	610
Milling wheat	6,100		Bird eggs	560
Sugar beet	4,900		Carrots and turnips	540
Grapes	3,600		Rice, paddy	530
Chicken meat	1,600		Olives	410
Tomatoes	1,400		Pineapples	350
Rape and mustard seed	1,400		Sheep and goat meat	350
Pig meat	1,200		Tangerines etc.	310
Oranges	1,200		Lettuce and chicory	300
Bovine meat	1,000		Sunflower seed	280
Apples	1,000		Brassicas	270
Barley	710		Cauliflower/broccoli	250
Palm oil	700		Soy oil	250

## LUC emissions as single pool and top-down approach

- All demand drives agricultural prices and land values
  - Thus contributes to pressures for LUC
- All commodities allocated a share of LUC emissions based on their land area requirements
- Land-hungry commodities allocated a large share of LUC emissions per tonne
- No double-counting of LUC emissions

# Themes: sets of mitigation measures

- **“Non-mobile energy”**
  - reducing GWP from the fuels like electricity or gas
- **“Mobile energy”**
  - reducing GWP from the fuels like diesel
- **“Direct GHG emissions”**
  - directly reducing direct emissions of GHGs to the atmosphere: methane, nitrous oxide and refrigerants
- **“Production efficiency”**
  - reducing waste, increasing FCR and crop yields and reducing the energy processing of food
- **“Conservation”** – recycling, AD
- **“Consumption”** – changing consumption

# Changing consumption

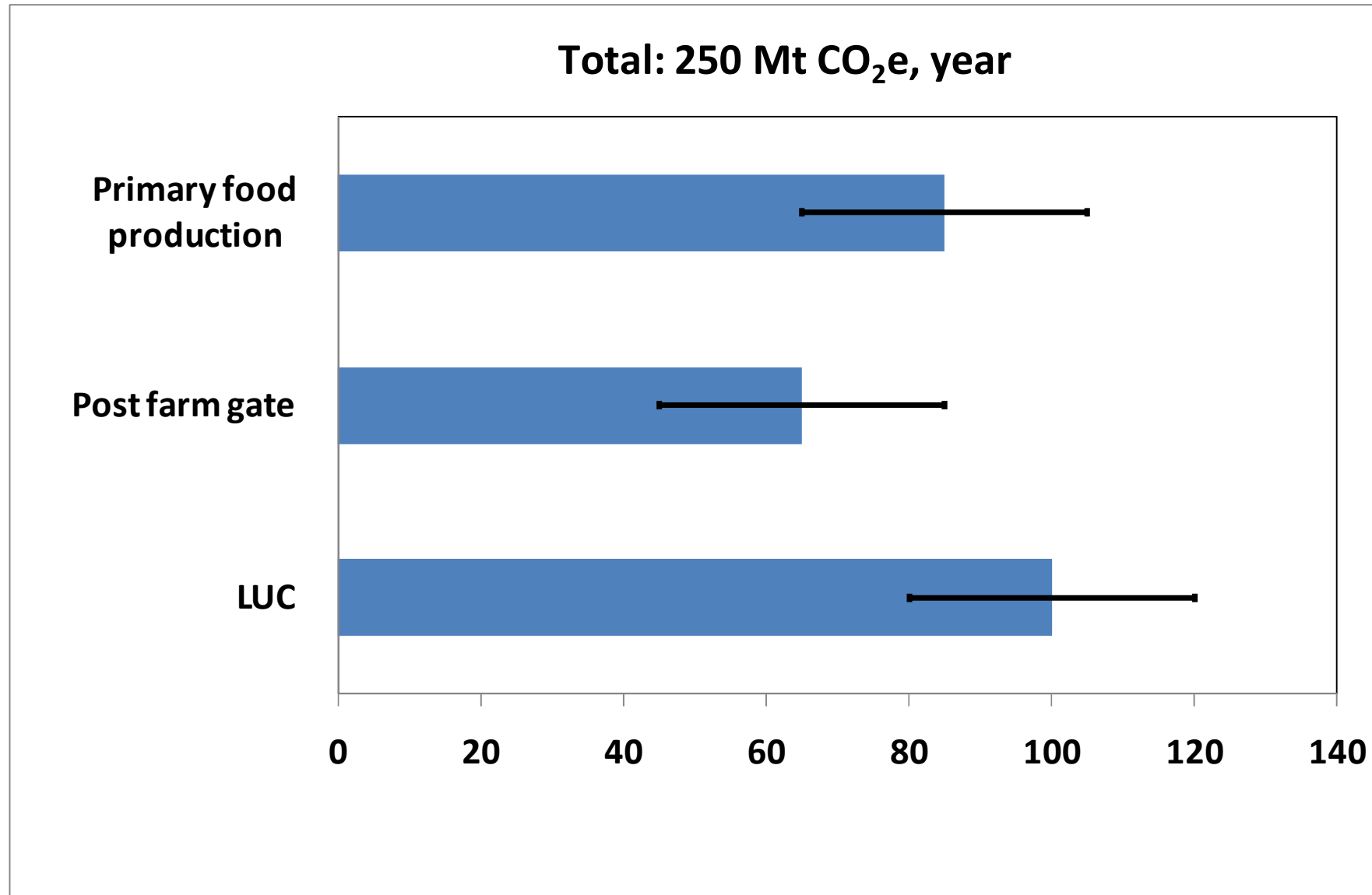
Measure	Comments
No meat	Fungal protein, tofu and pulses
66% reduction in livestock products	Other food increased by 29%
50% reduction in livestock products	Other food increased by 21%
Red to white meat	More vegetables to balance
No dairy milk	Soy based milk products
No rice	Wheat and potatoes
No eggs	“Soy synthetic egg”

**No fish for meat**

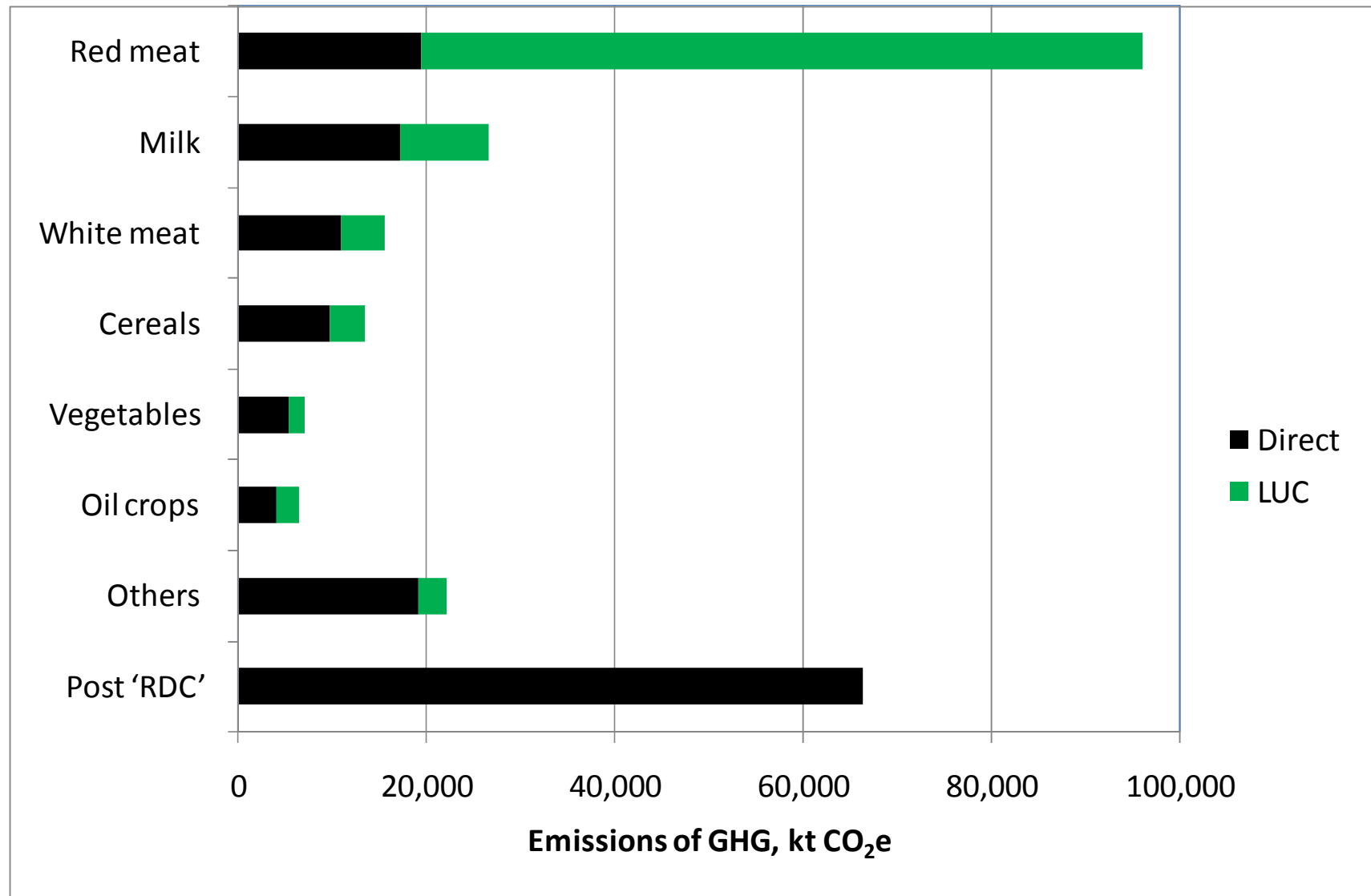
**CH<sub>3</sub>-CH<sub>2</sub>OH the same!**



# Results – the inventory

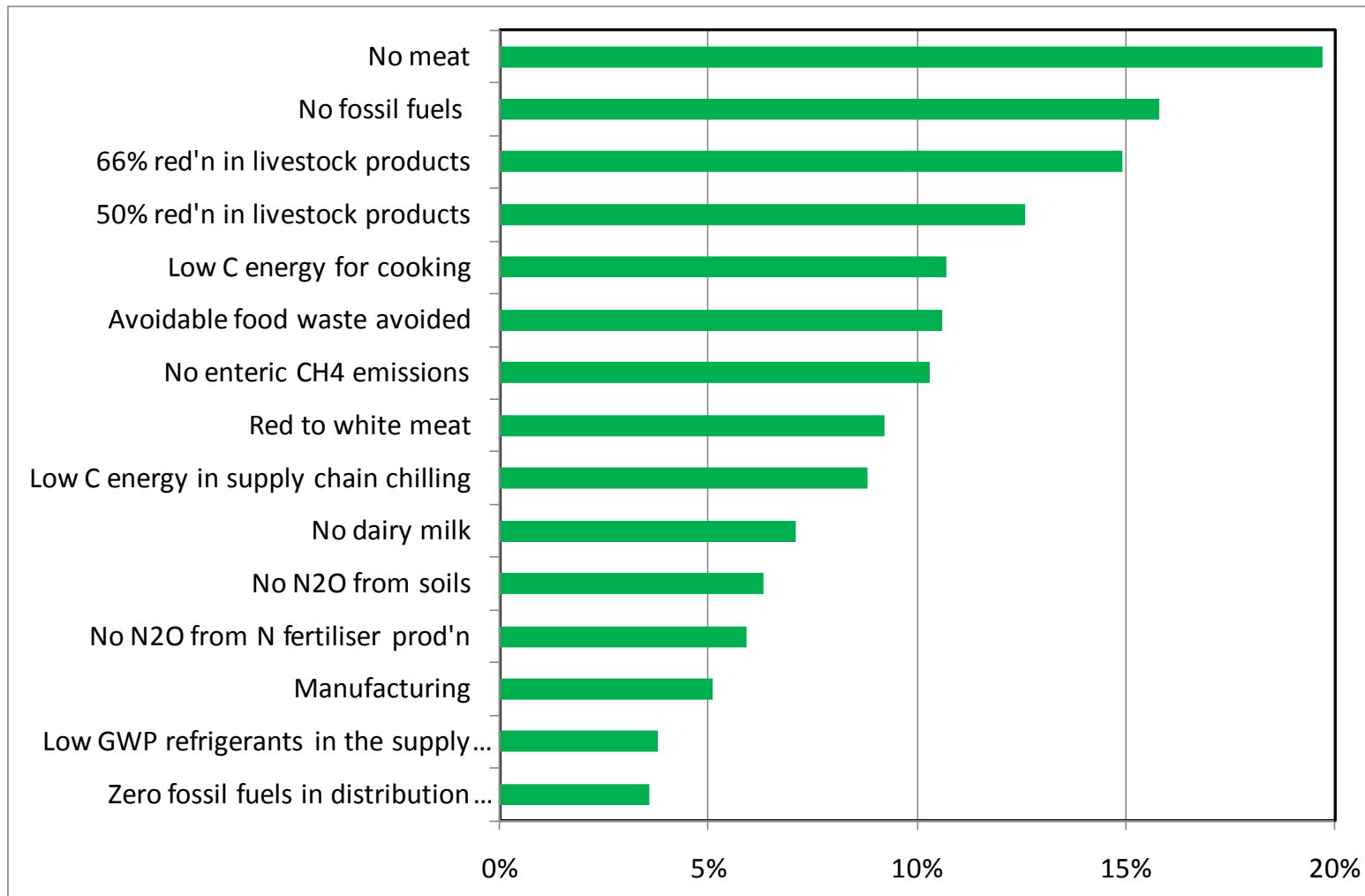


# Inventory breakdown

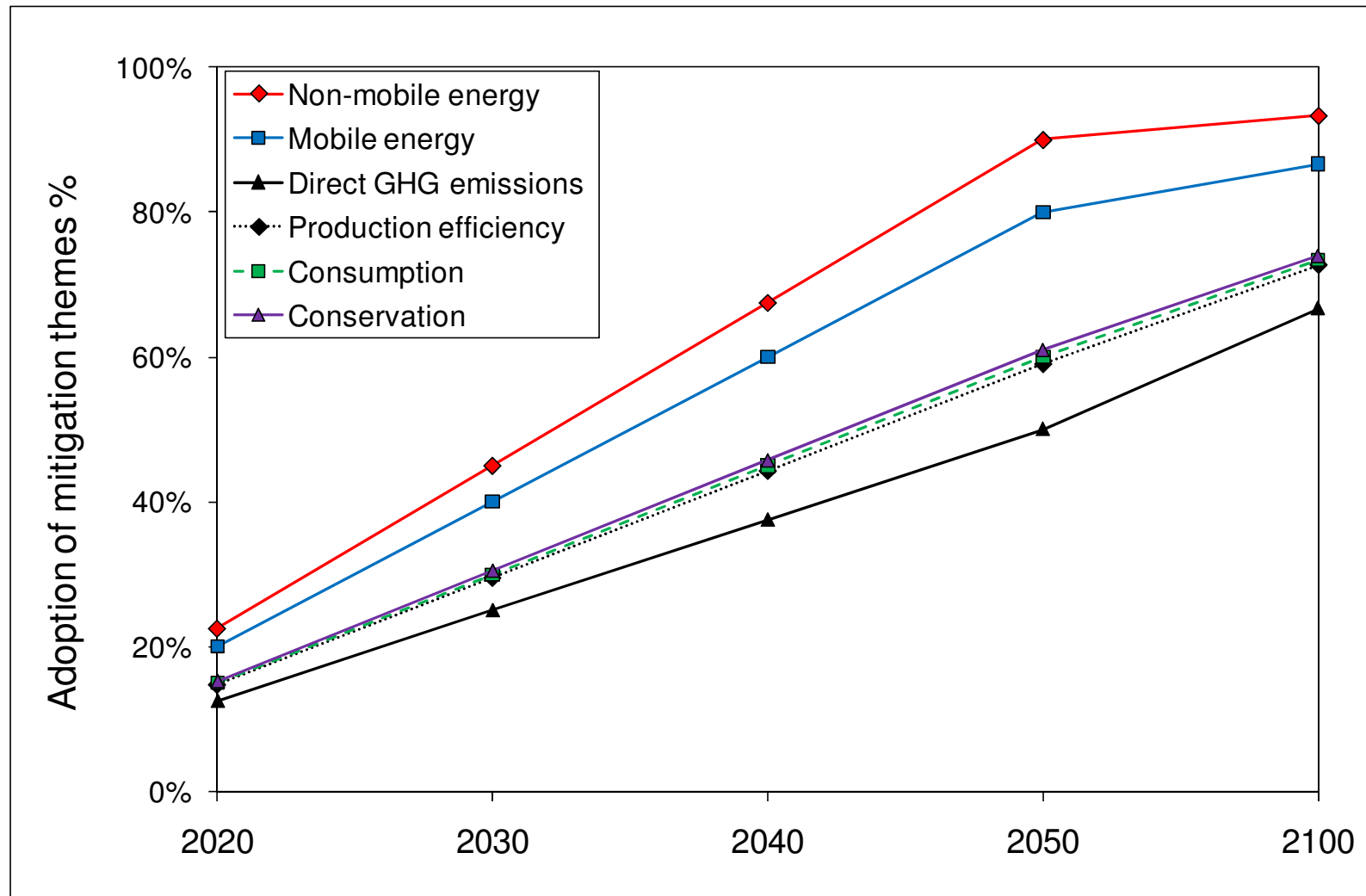


# Effectiveness of top 15 measures

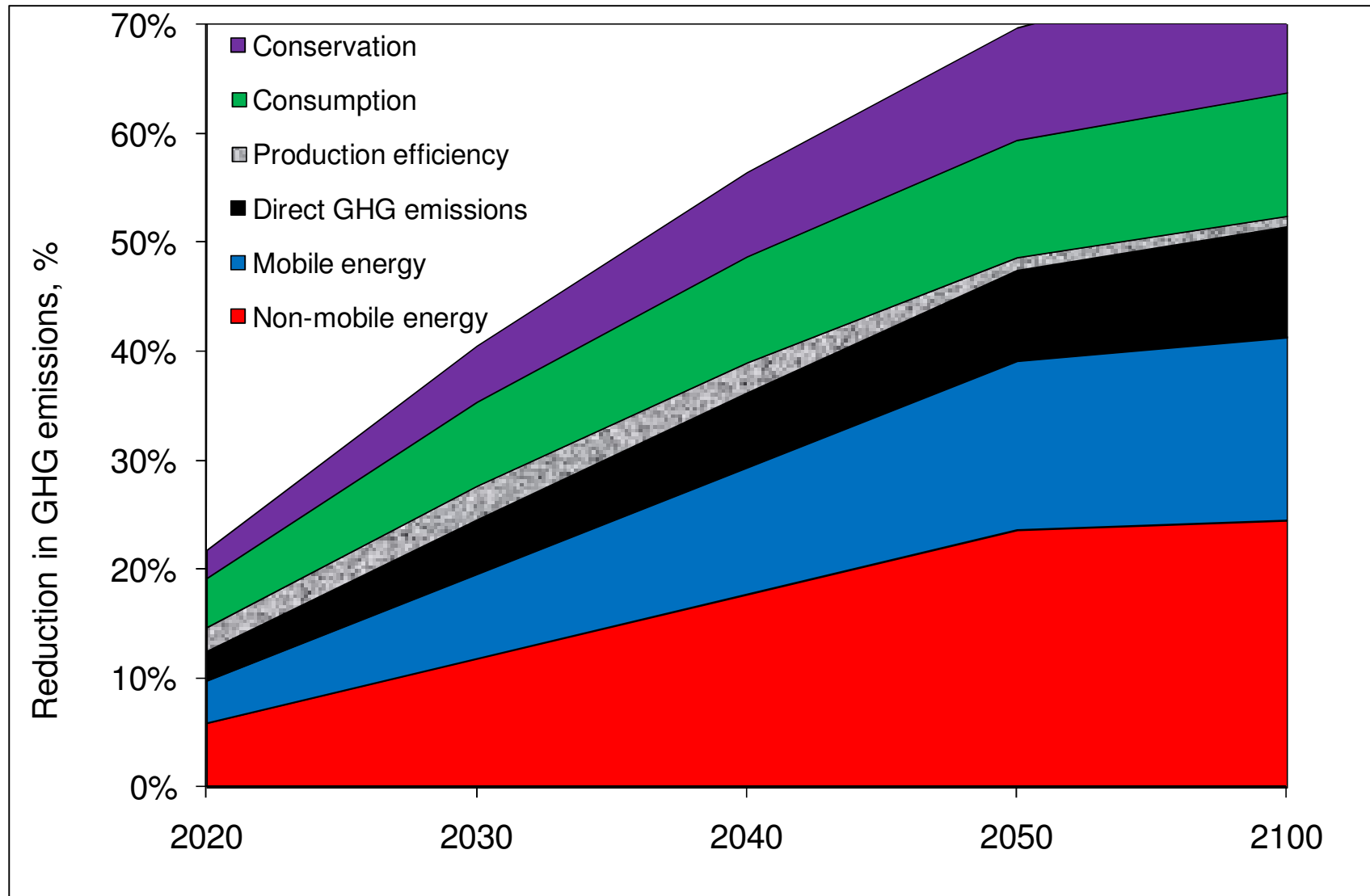
## Supply chain only – not LUC



# Implementation of themes



# Expected effectiveness of themes



## Concluding discussion

- **Inventory:** 250 Mt CO<sub>2</sub>e (cf. all UK 750)
  - Production, post farm & LUC similar
- Caveats: data sources, service sector...
  - LUC big + much debate
- **70% just possible**, but all themes – not just one
  - Cleaner energy, refrigerants & technology
  - Also apply **across sectors**
- **Behavioural change:** diet, food waste,
  - Massive changes in technology and society
- Land may become available.....

**Many thanks for funding**



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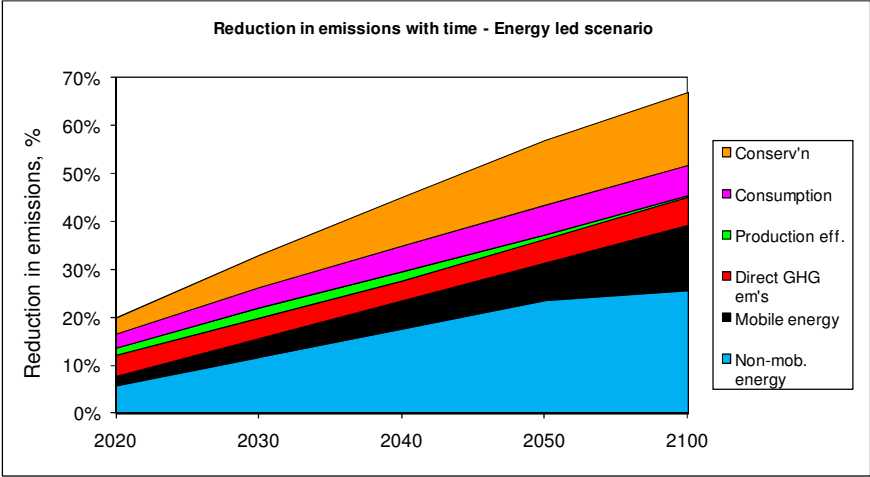
## LUC Method (6 steps)

1. Calculate total LUC emissions per year ( $\text{GtCO}_2\text{e/yr}$ )
2. Find the proportion of total LUC caused by commercial agriculture, including ranching (% of LUC)
3. Divide LUC emissions attributable to agriculture by total agricultural land area to derive LUC emissions per hectare ( $\text{tCO}_2\text{e/hectare}$ )
4. Calculate land requirement for each food commodity consumed in the UK (hectares/tonne of commodity)
5. Multiply LUC factor (3.) by commodity land requirement (4.) to derive LUC emissions per tonne of commodity ( $\text{tCO}_2\text{e/tonne}$ )
6. Multiply LUC factor per tonne of commodity by total quantity of commodity consumed in the UK ( $\text{tCO}_2\text{e/yr}$ )

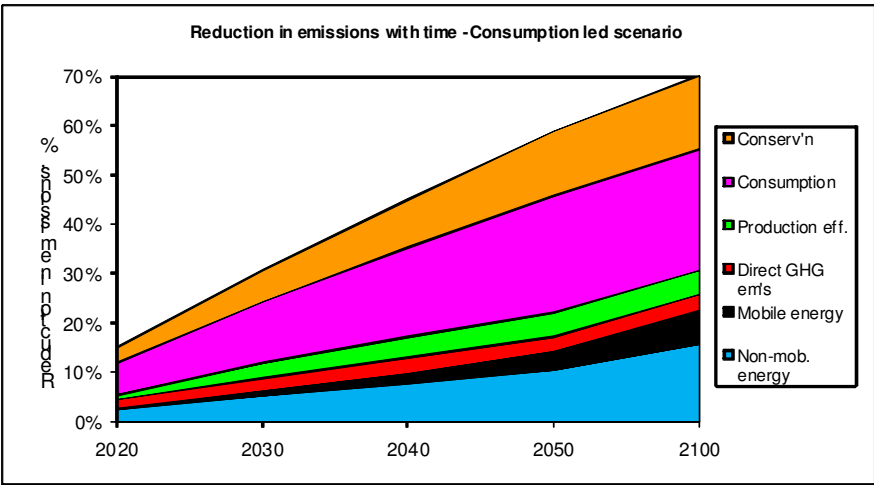


# Measures (2)

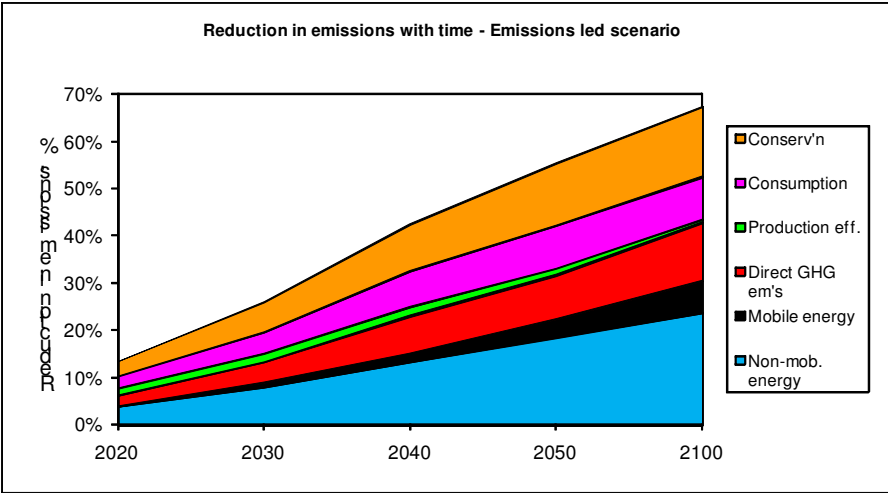
Energy Led



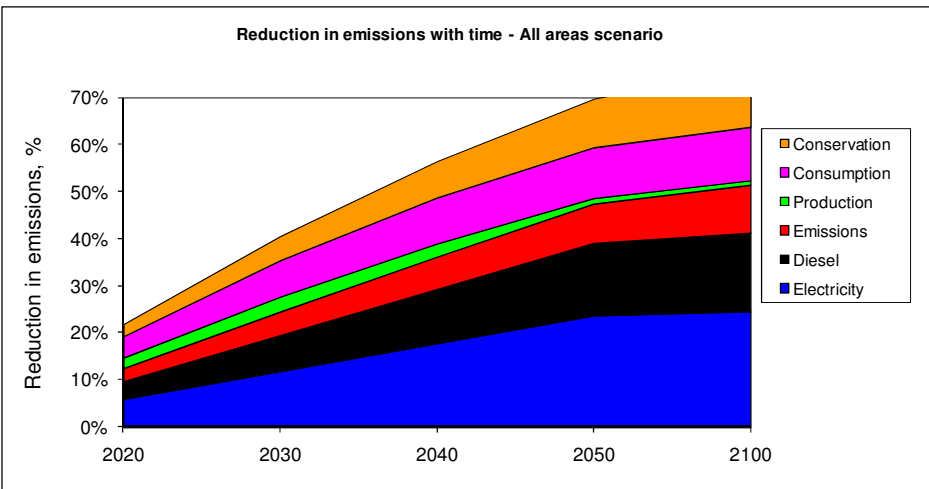
Consumption Led



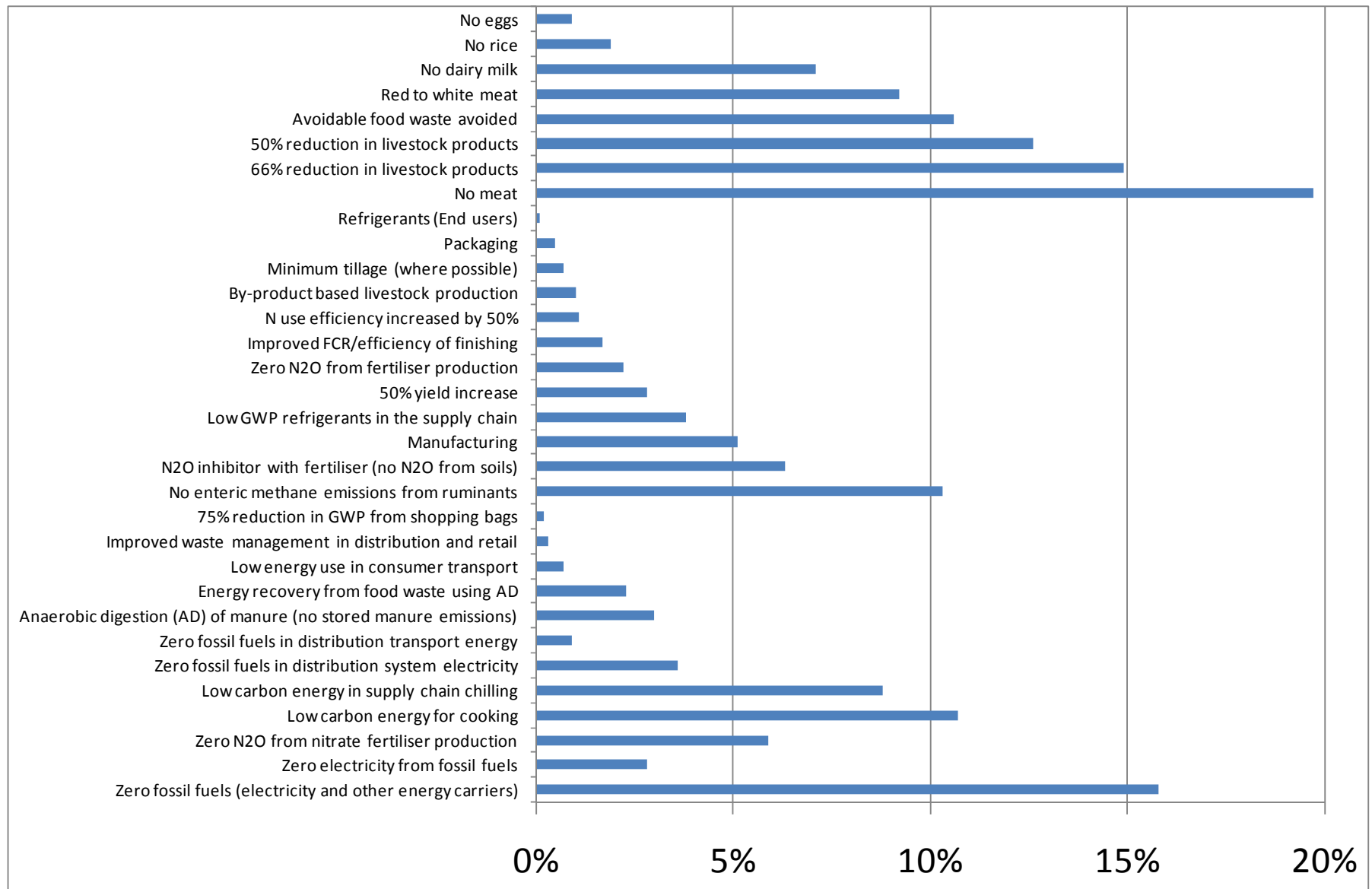
Emissions Led



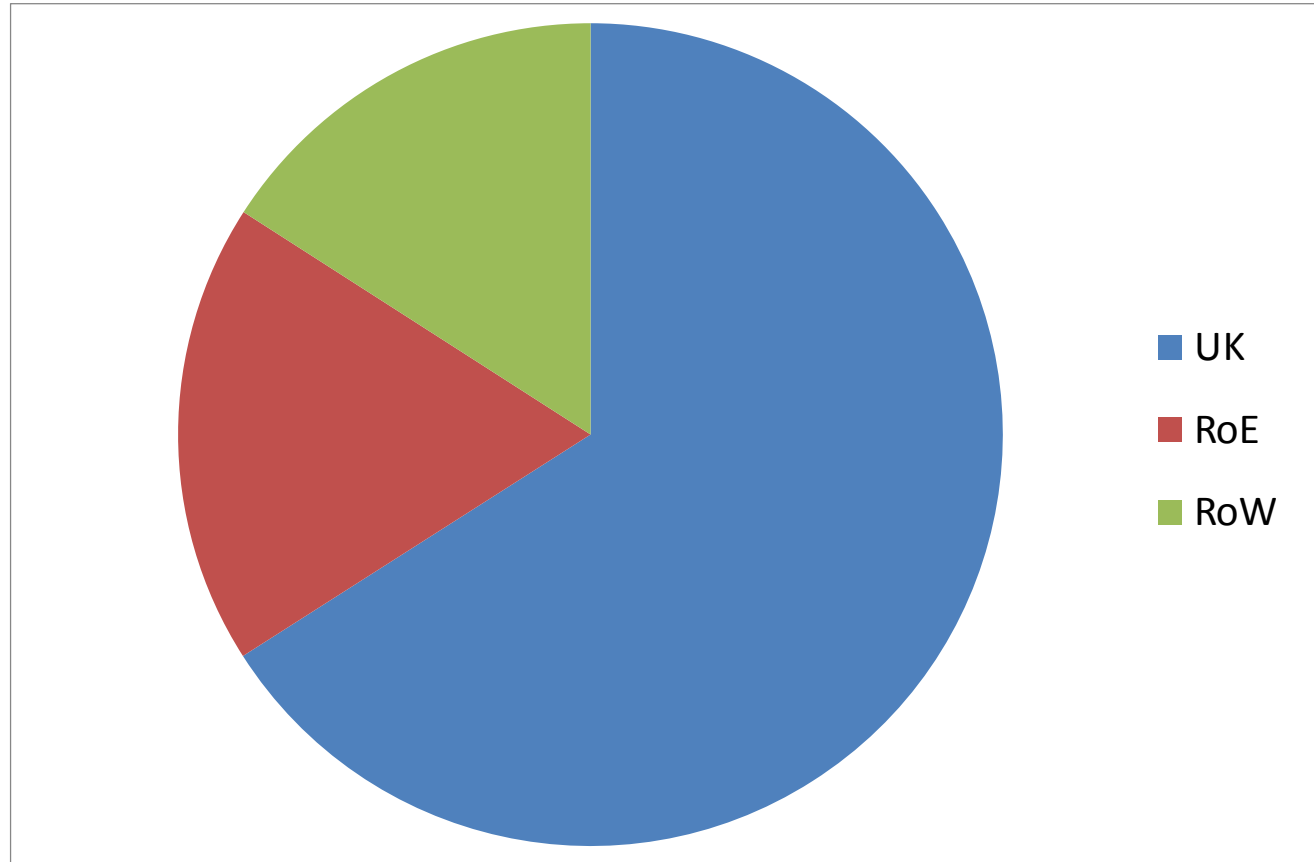
All



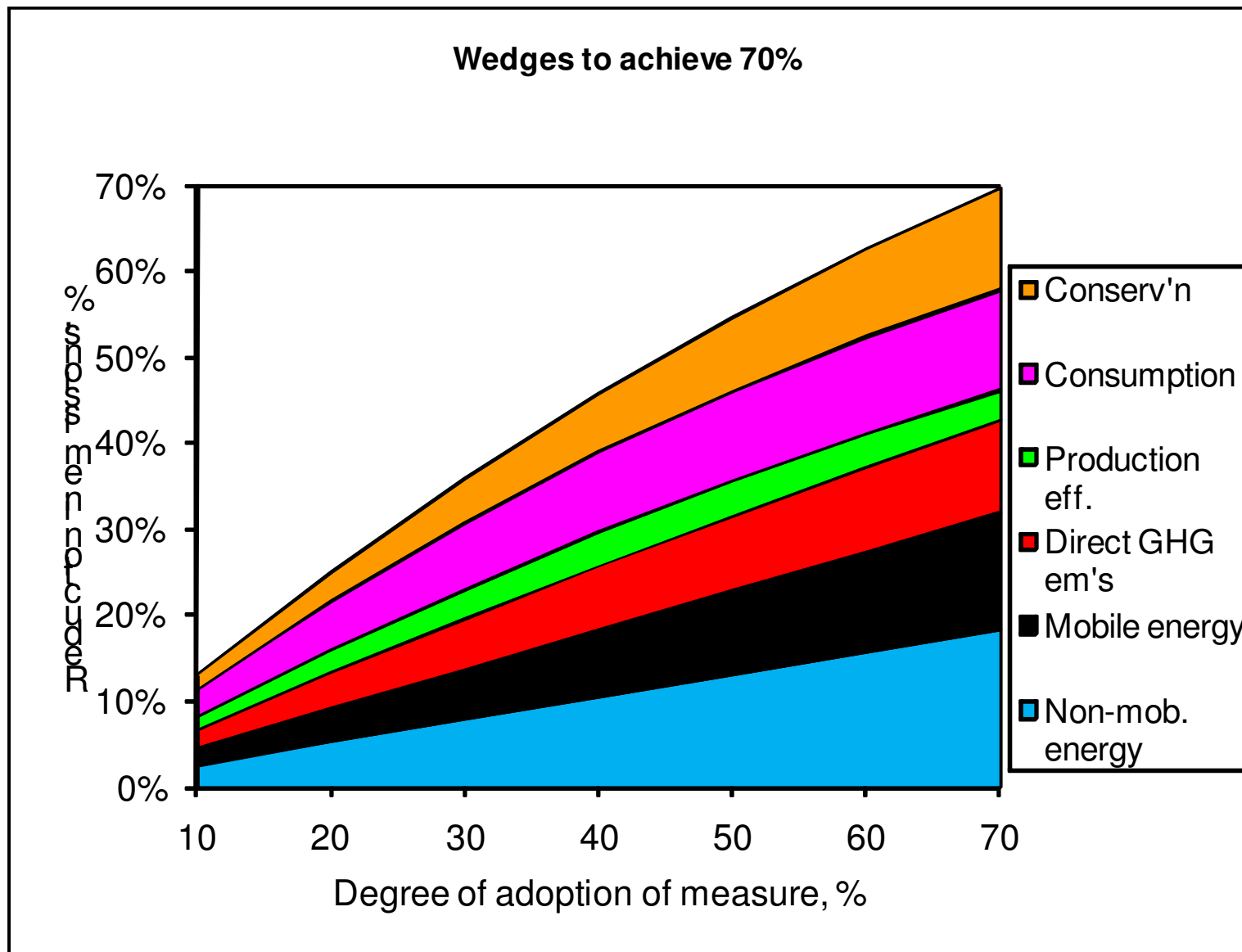
# Supply Chain Emission Reduction Potentials *Cranfield* UNIVERSITY



# Location of supply chain emissions (exc. LUC)



# Measures



# Themes and measures

