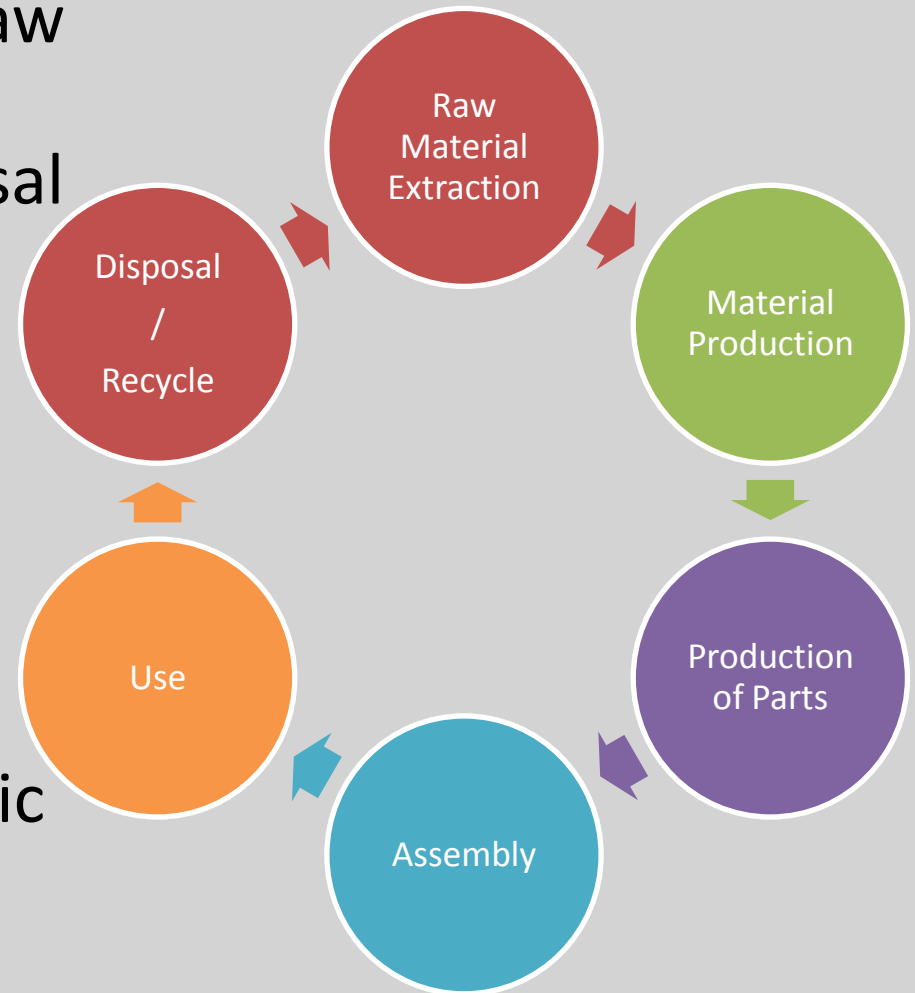


Life Cycle Assessment of a 100% Australian-Cotton T-Shirt

Institute for Sustainable Resources
Queensland University of Technology
2009

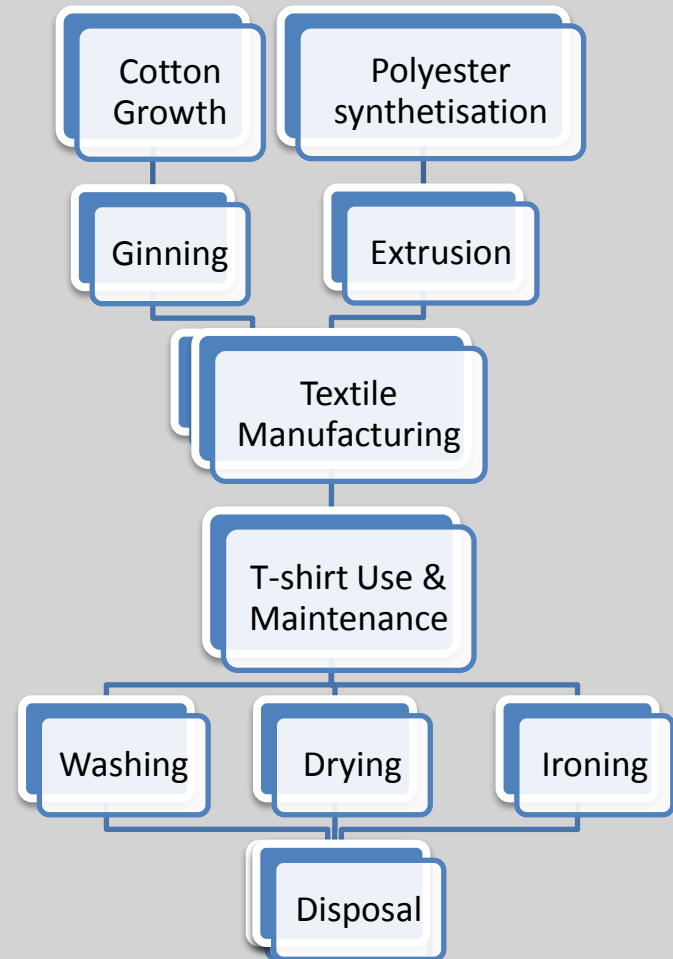
Life Cycle Assessment

- Includes production of raw materials, product assembly, use and disposal
- Includes environmental impact from producing inputs (petrol, buildings, fertilisers, etc)
- Identifies environmental hotspots
- Quantitative and scientific basis



The Study

- Main Focus:
 - GHG emissions
 - Fossil fuel depletion
- Goals:
 - Market communication
 - Identify GHG reduction possibilities in the production and manufacturing chain



Environmental Categories

- Climate Change -> Direct GHG emissions
 - Soil N₂O emissions
 - Cattle CH₄ emissions (if applicable)
 - Plant and soil decomposition (CO₂)

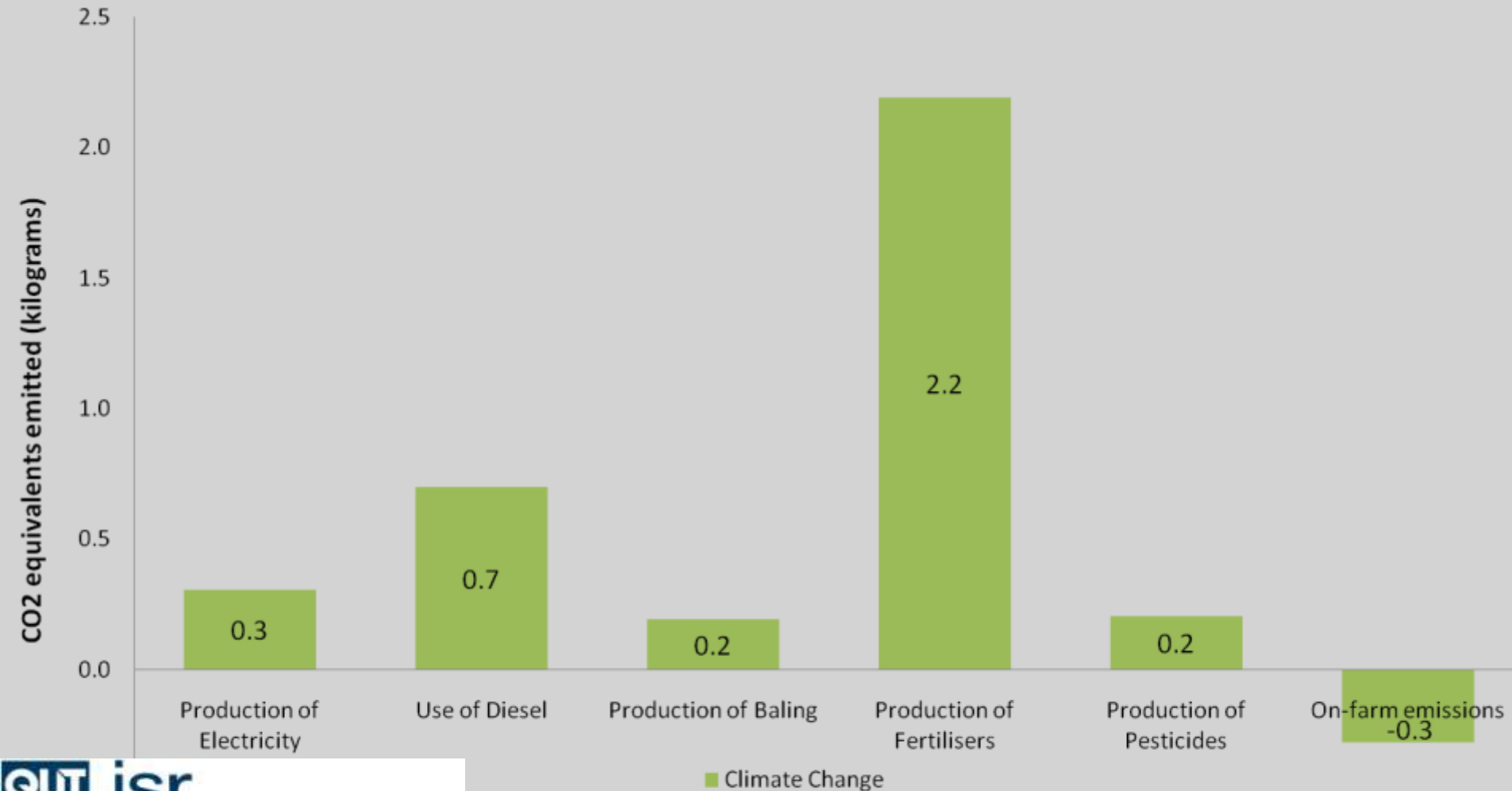
- Fossil Fuel Depletion
 - Burning of fuel for machinery (production and manufacturing)
 - Burning of coal to produce electricity
 - Use of crude oil as input material (fertilisers, polyester)

Other Environmental Categories

- Ozone Layer Depletion
 - Emission of CFCs or other ozone depleting substances
- Mineral Resources Depletion
 - Depletion of phosphorus
 - Depletion of uranium

Cotton Production Carbon Footprint

- Carbon Footprint: 3.3 kg CO₂e/kg cotton



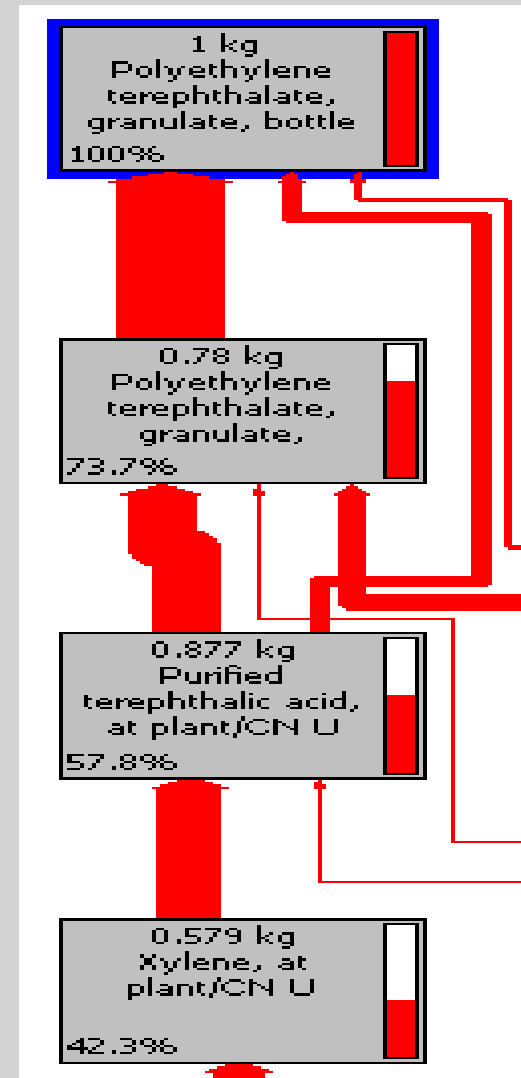
On-Farm GHG Emissions

- Assume Standard N fertiliser 200 kg N/ha
+ 0.101 kg CO₂e/kg cotton
- On-farm use of fuel
+ 0.15 kg CO₂e/kg cotton
- Cotton plant absorbs CO₂
- 0.567 kg CO₂e/kg cotton

Net On-farm Emissions are **-0.279** kg CO₂e/kg cotton

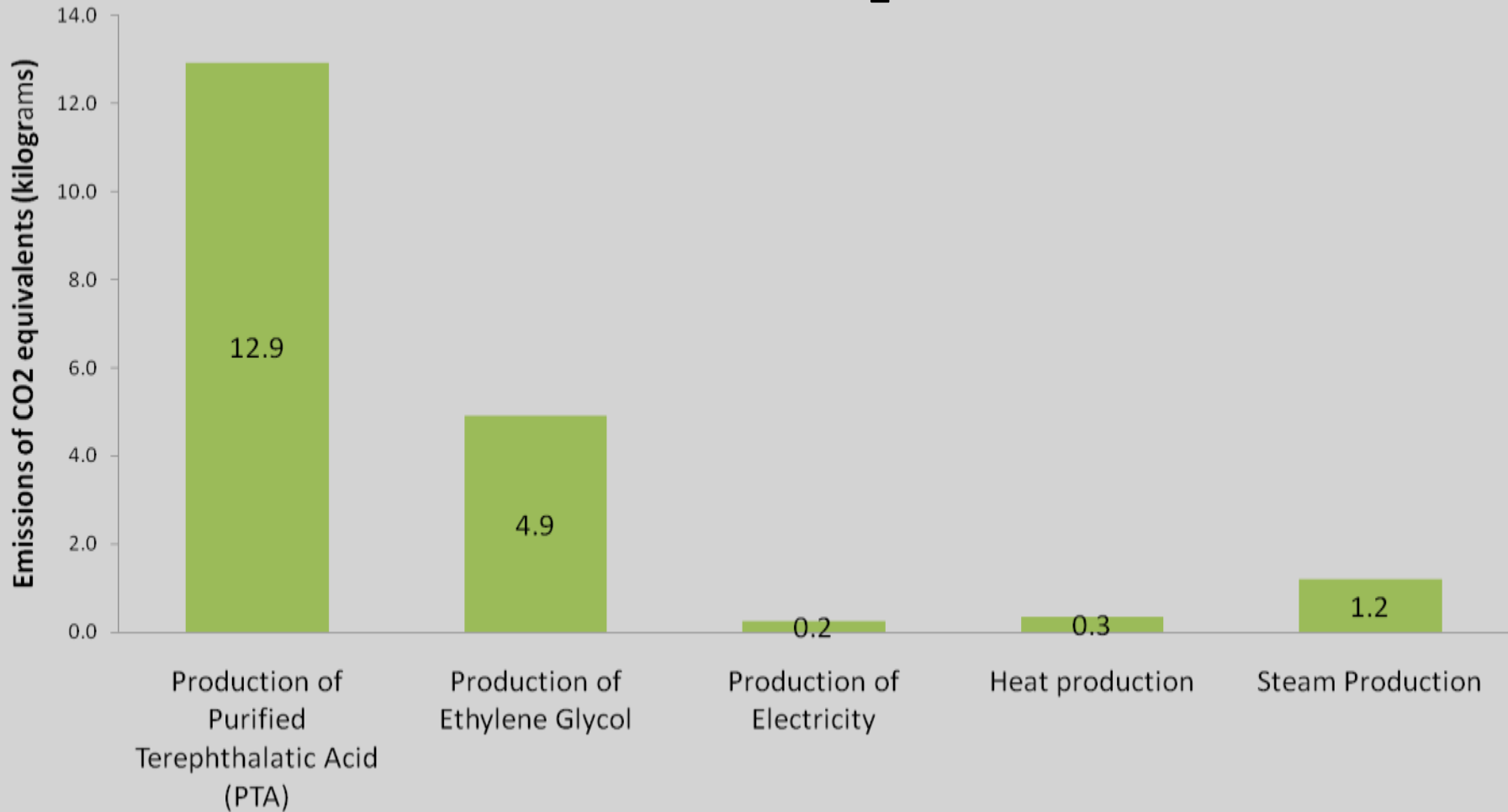
Polyester Production

- Why is polyester worse for the environment?
 - Synthetisation requires significant amounts of energy
 - Based on Xylene -> Crude Oil
 - Oil extraction and export very energy-demanding and contaminating



Polyester Carbon Footprint

- Carbon Footprint: 20 kg CO₂e/kg polyester



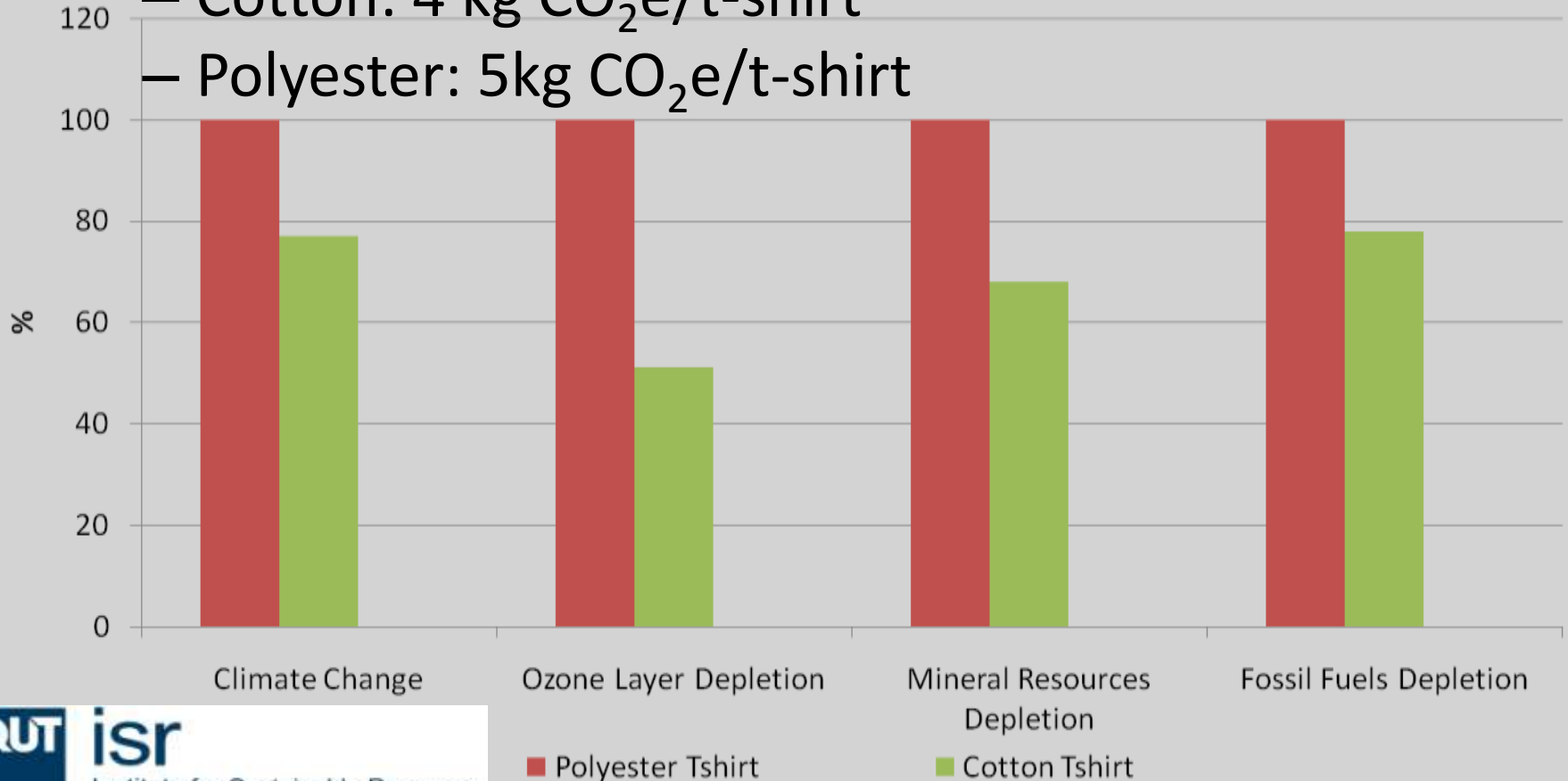
■ Climate Change

Cotton vs. Polyester

- Overall, cotton is better for the environment than polyester
- Estimated GHG emissions from production:

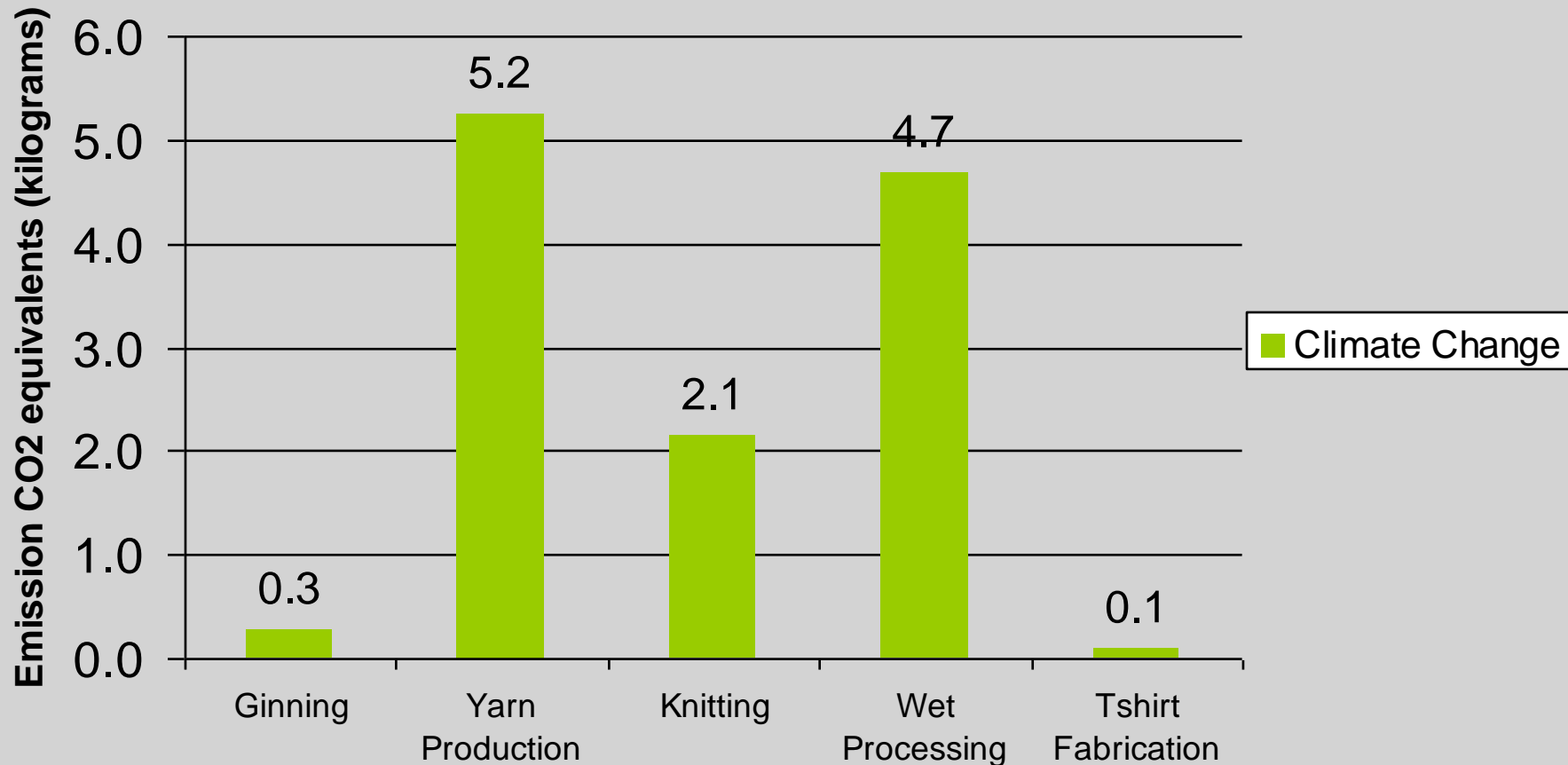
– Cotton: 4 kg CO₂e/t-shirt

– Polyester: 5kg CO₂e/t-shirt



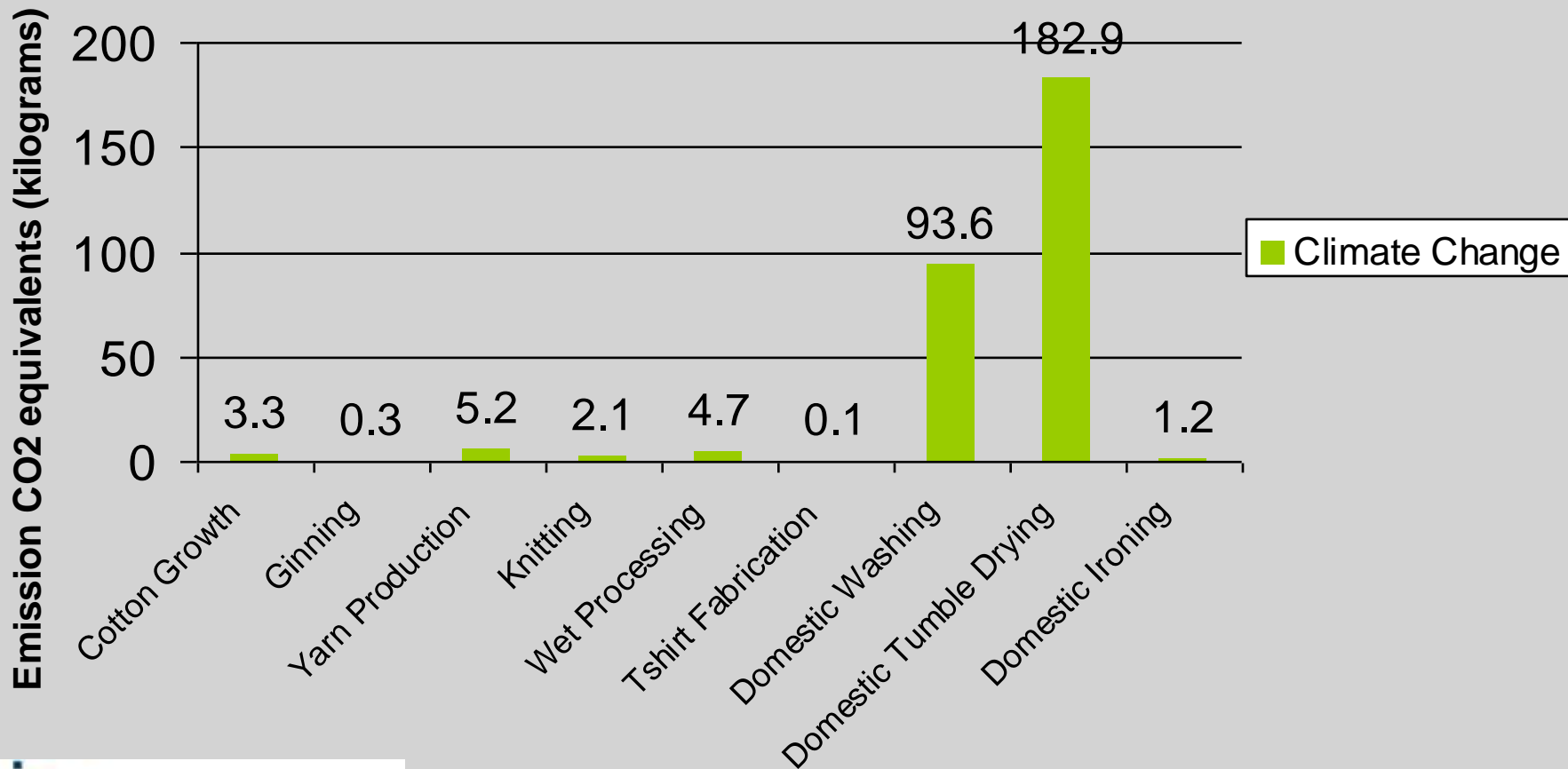
The Textile Manufacturing Phase

- Contributes 12.5 kg CO₂e/kg textile



The Use Phase

- Dominates the Life Cycle -> 75 wash-dry operations
 - 96% of whole of life-cycle impact (277 kg CO₂e/t-shirt)

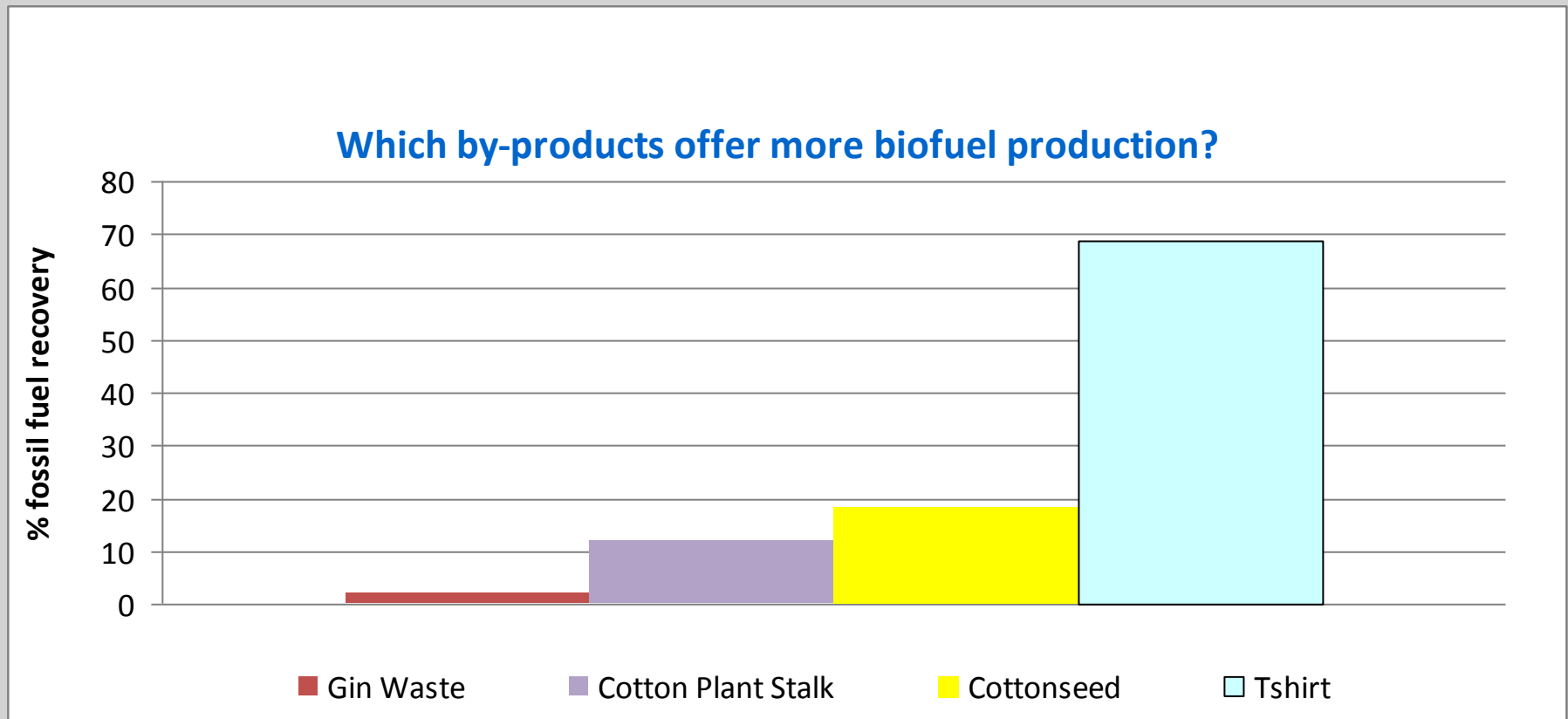


Reliability of Results

- High reliability
 - Specific and accurate sources
 - Use of reliable LCA databases
- Need to understand the goal of the study
 - Not about how much better cotton is
but about which product is clearly better
 - Figures of GHG emissions are approximate

How to make cotton production greener

- Improve fertiliser efficiency and management
- Reduce diesel consumption



Future Research

- Improve accuracy
- Assess other environmental categories
 - Water use (water depletion, water contamination...)
 - Land use (biodiversity, soil salinisation...)
- GHG reduction options
- How to maximise environmental benefits from cotton by-products