SYSTAIN CONSULTING

THEKEY.TO ACADEMY

The Carbon Footprint of Textiles

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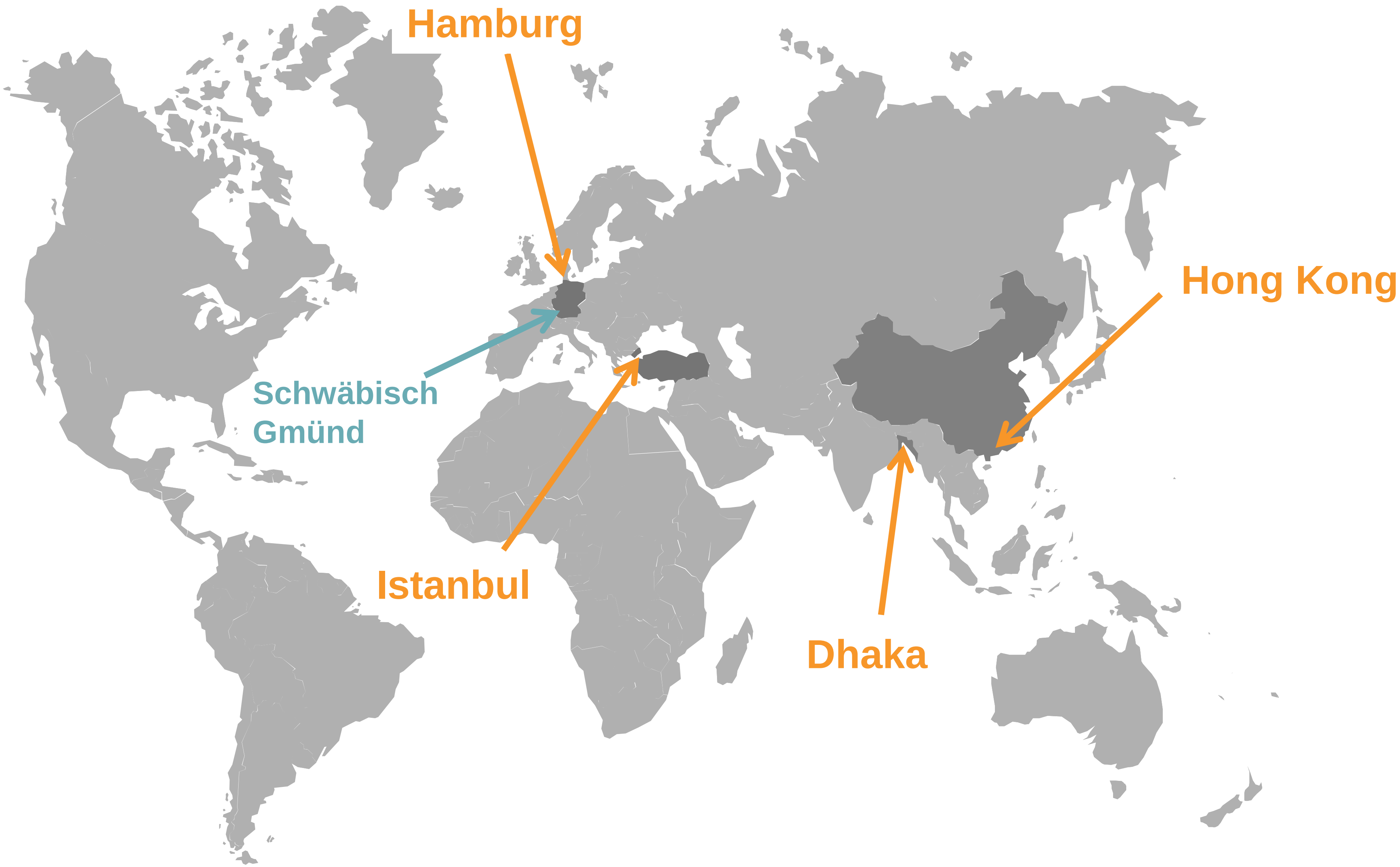
Systain Consulting – more than 10 years of passion for sustainability

Systain Consulting is an experienced CSR consultancy. Together with our clients, we develop tailor-made and pragmatic solutions for sustainable management – with main focus on the supply chain. Our clients range from brands, retailers, importers and producers.

The Systain team offers:

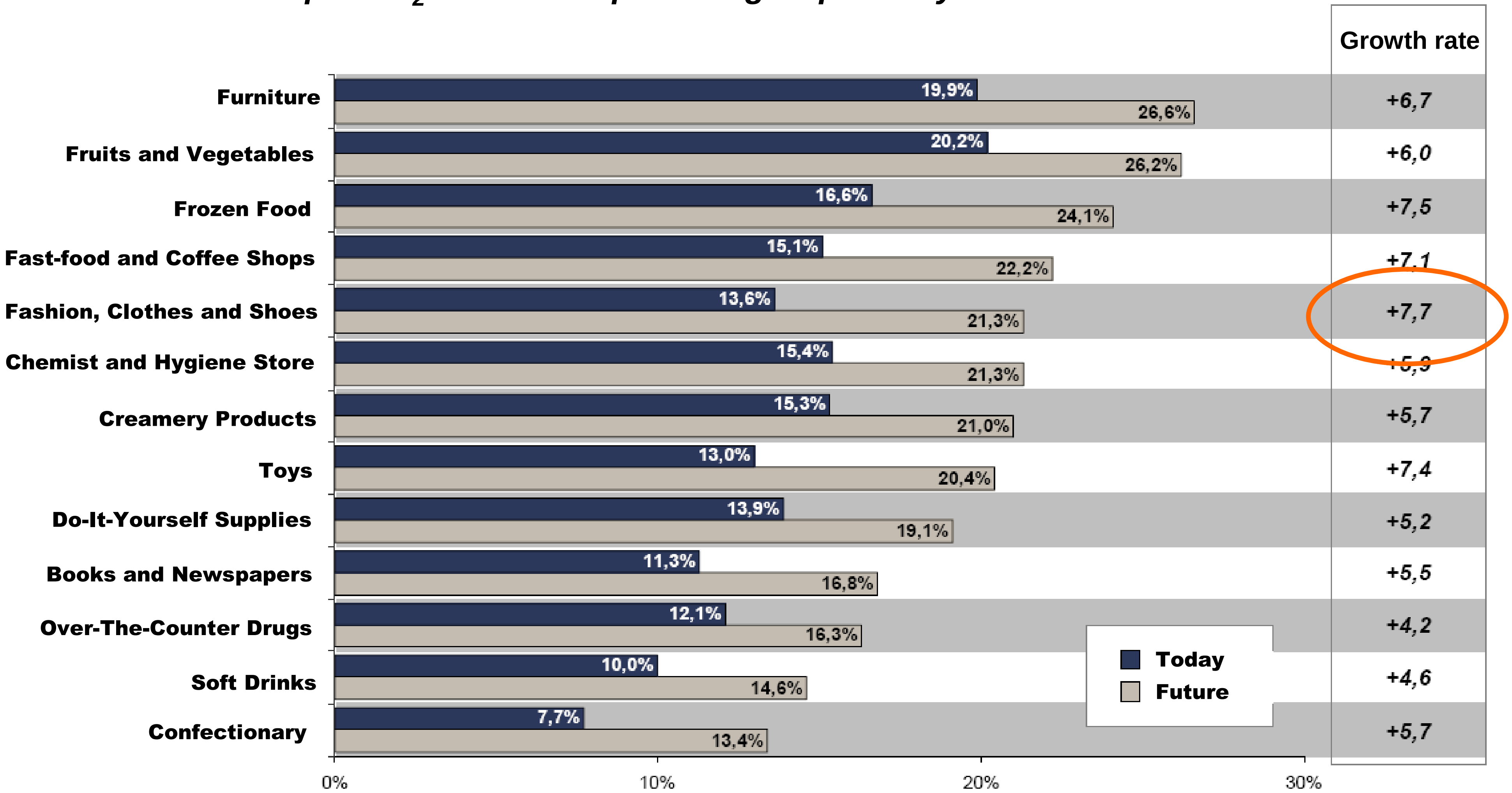
- Systematic solutions for sustainability
- Comprehensive business know-how
- Performance-oriented consultancy
- Headquarter in Hamburg and offices in the main production markets
- 25 employees of various nationalities in 4 countries

Systain worldwide



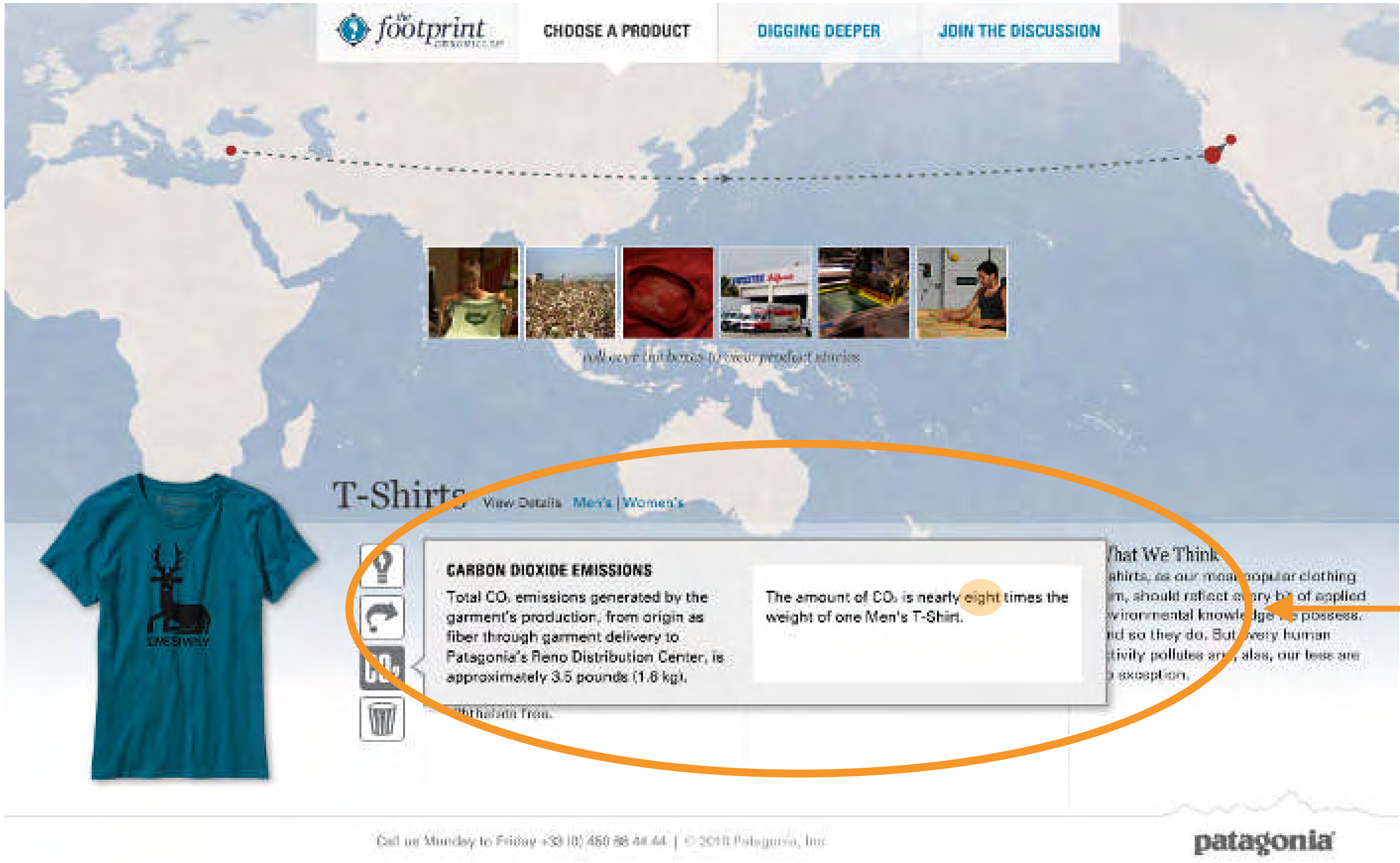
Carbon Emissions are faced an increasing awareness among consumers

Relevance of the topic CO_2 for several product groups today and in the future



Survey among 1.011 consumers in Germany, carried out by Sempora, Sept. 2007

Patagonia (U.S.): information about environmental impact of textiles



Information about the carbon footprint

Carbon footprint related to the weight of the textile

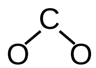
Information about energy consumption, waste etc.

Trace & tracking for consumers

➔ Regular T-Shirt: CO_2 equals **eight** times the weight of the shirt

www.patagonia.com

Fossile fuels cause CO_2-emissions

1) Bestandteile: 1 Atom Kohlenstoff (C), 2 Atome Sauerstoff (O = ½O_2)
2) Summenformel: $\mathbf{CO_2}$
3) Strukturformel: 
4) Molare Massen: C = 12 g/Mol, ½O_2 = 16 g/Mol, CO_2 = 44 g/Mol
5) Aus 4) ergibt sich für CO_2 ein Anteilsverhältnis von 1 : 1,3 : 3,67 (C : ½O_2 : CO_2)
6) Der Kohlenstoffanteil in fossilen Brennstoffen liegt bei ca. 85%

    1 kg fossilen Brennstoff = ca. 850 g Kohlenstoff (C)
7) Dichte von verschiedenen fossilen Brennstoffen:

    7.1) Dieselkraftstoff = ca. 845 g /Liter
    7.2) Ottokraftstoff = ca. 750 g /Liter
    7.3) Schweröl = ca. 1.000 g/Liter

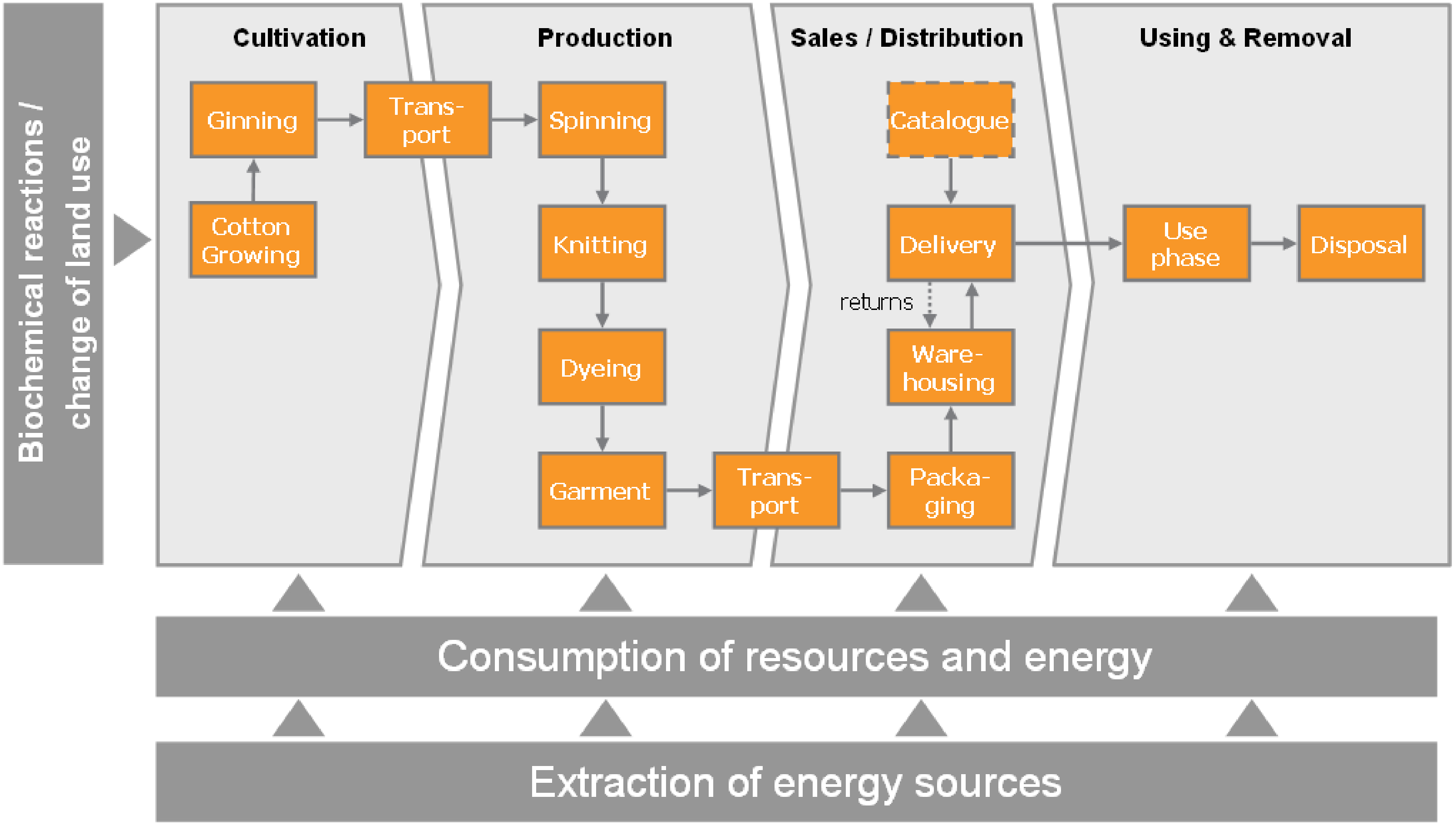
Beispielrechnung für Diesel

- Ein Liter Diesel hat eine Masse von ca. 845 g (siehe 7.1)
- Da der Masseanteil von Kohlenstoff in fossilen Brennstoffen bei ca. 85% liegt (siehe 6), enthält ein Liter Diesel ca. 718,25 g Kohlenstoff.
- Entsprechend dem unter 4) ermittelten Kohlenstoffanteil für CO_2 entstehen bei vollständiger Oxidation von einem Liter Diesel: 718,25 g C * 3,67 g CO_2/g C= **2,6 kg CO_2/ Liter Diesel**

*für Diesel (ohne Emissionen bei Förderung und Raffinierung

* 1 Mol = 6.0221367 * 10^{-23} Teilchen (Avogadrosche Zahl) ** Dieser Wert schwankt mit der Kraftstoffdichte

The Carbon Footprint indicates all greenhouse gas emissions along the whole life-cycle



The journey of a longshirt: from the cotton field in the U.S. via the factory in Bangladesh to the consumer in Germany

Figure: google

Long shirt ‚Boysen's', ¾ sleeve, white, 100% cotton, Size 40-42, Net weight 222 grams

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit

Umwelt Bundes Amt – Für Mensch und Umwelt

Öko-Institut e.V. – Institut für angewandte Ökologie – Institute for Applied Ecology

otto group

corsus Corporate Sustainability

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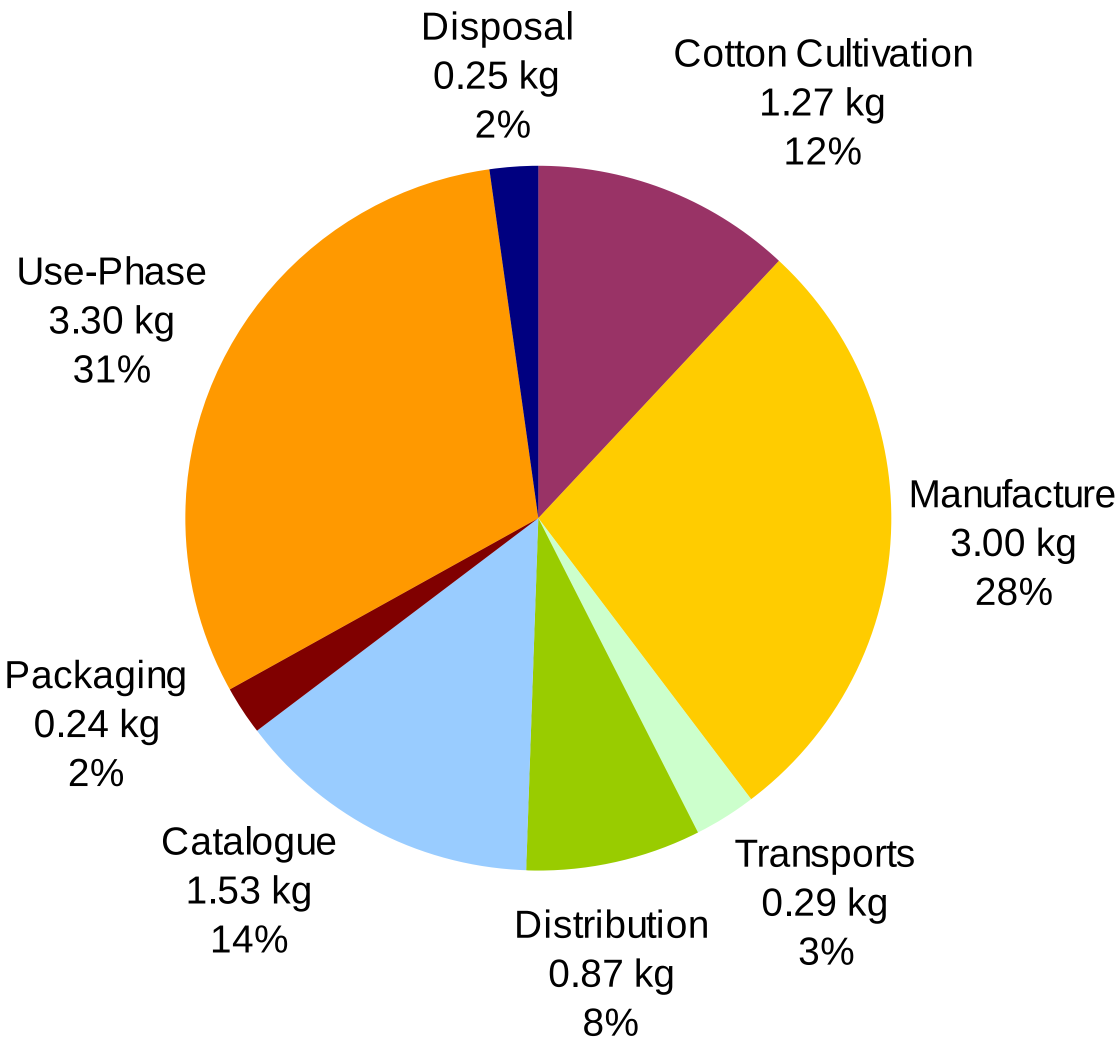
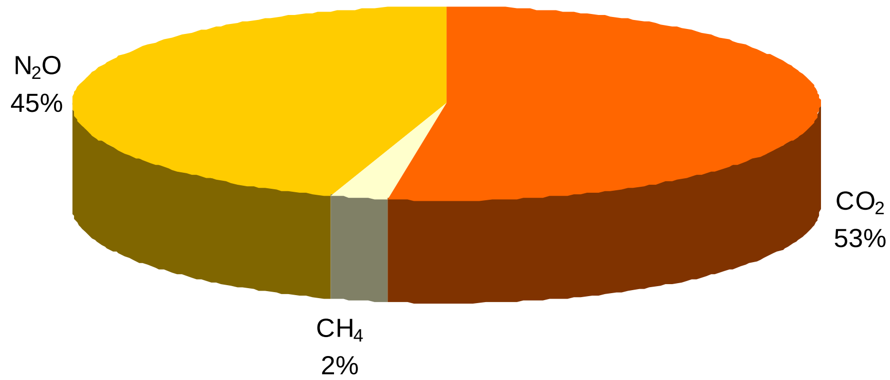
Carbon Footprint of the white longshirt: 10.75 kg CO_2e, 50 times the net-weight



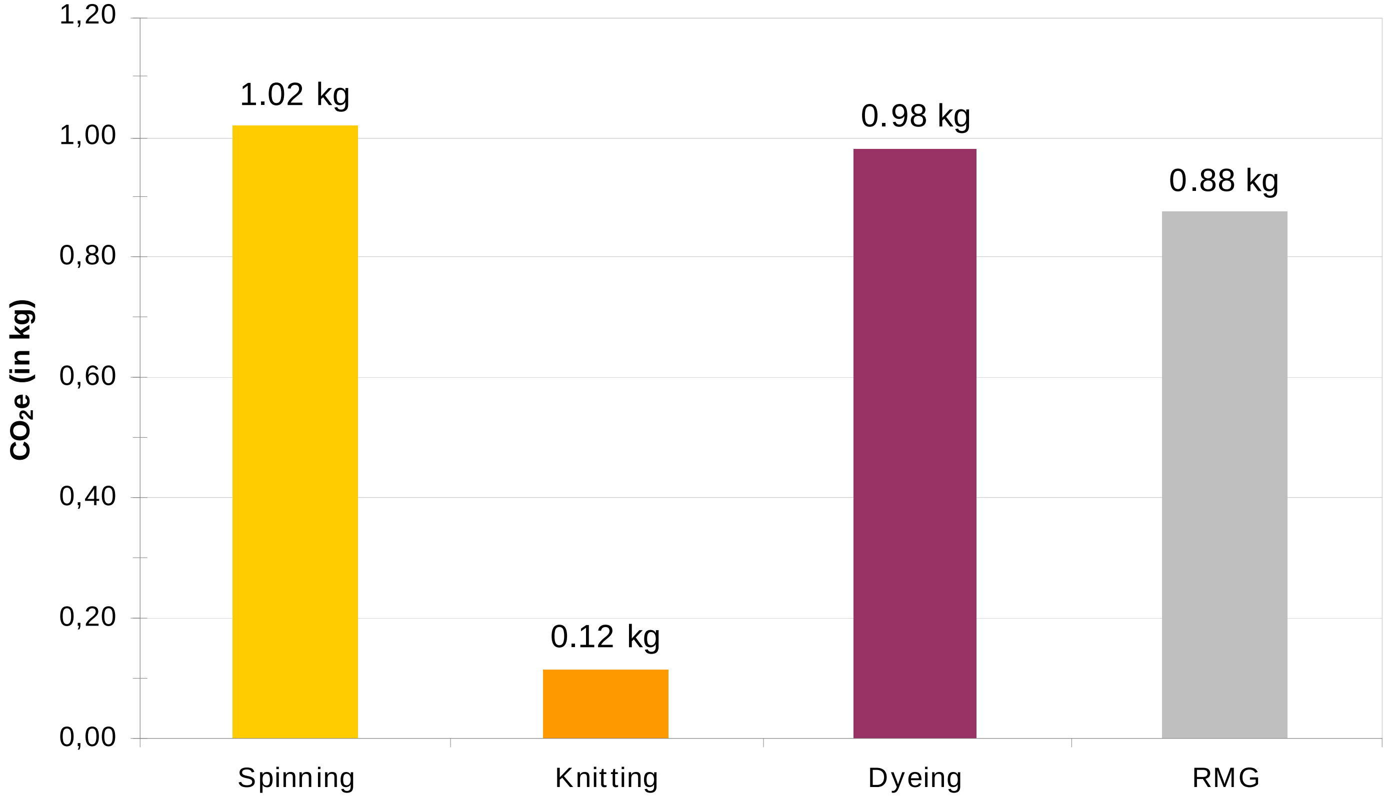
N_2O-gases are linked to cotton growing and have an almost 300-time larger effect than CO_2

- The Carbon Footprint regarding cotton growing incl. ginning makes up 1,27 kg CO_2e.
- Indicated by generic secondary data due to data gaps for cotton growing.
- Almost half of it caused by direct and indirect nitrous oxide emissions (N_2O), which has a Global Warming Potential (GWP) of 298 relative to CO_2



- The level of uncertainties is quite high:
  - Direct emissions of N_2O depends on temperature, soil structure, the use of fertilizer, water etc.
  - Production of fertilizers – no data outside the western hemisphere available
  - Land use Change?
  - Carbon sequestration by the cotton?

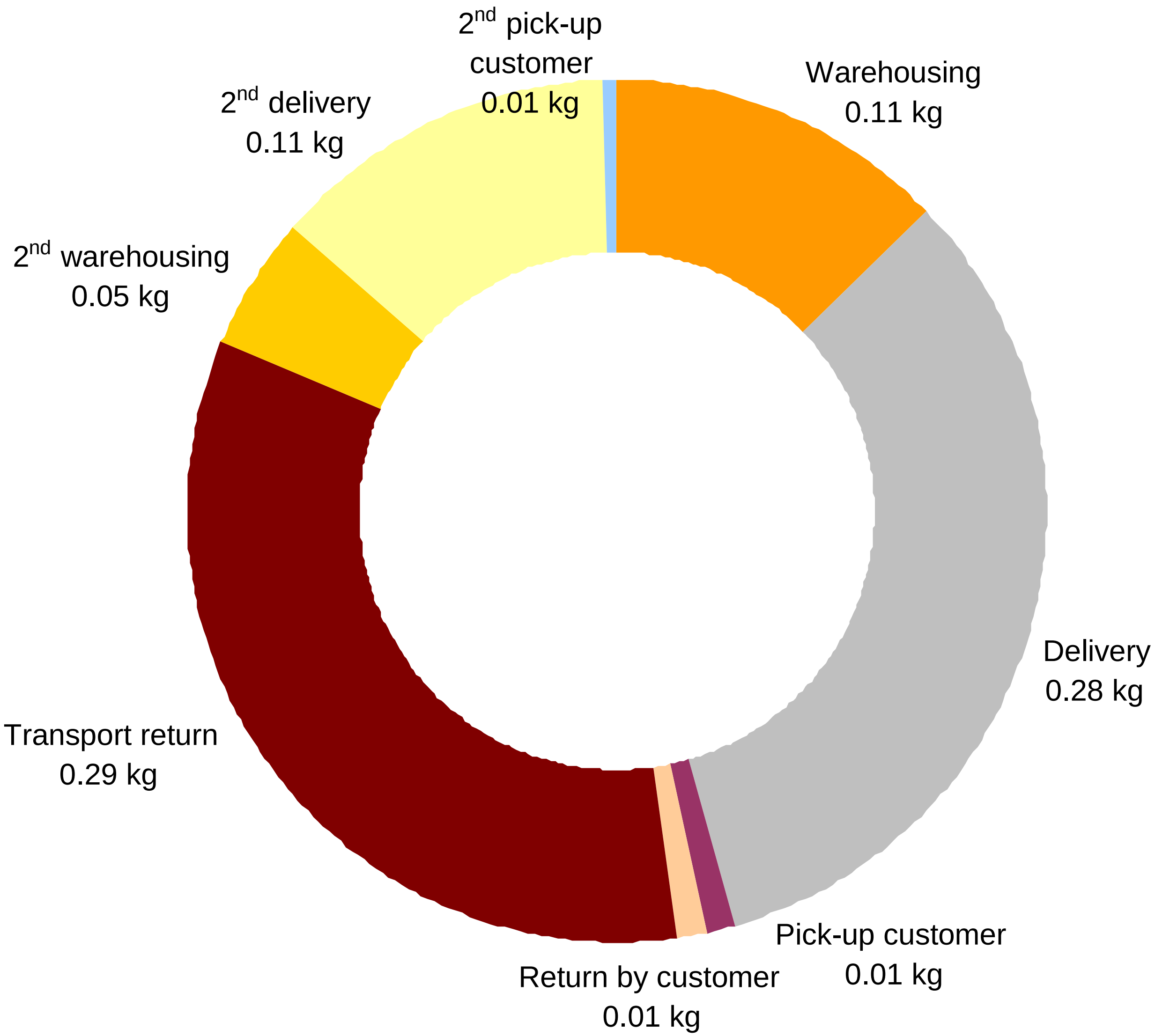
Manufacture implies an emission-level of 3.0 kg CO_2e per functional unit



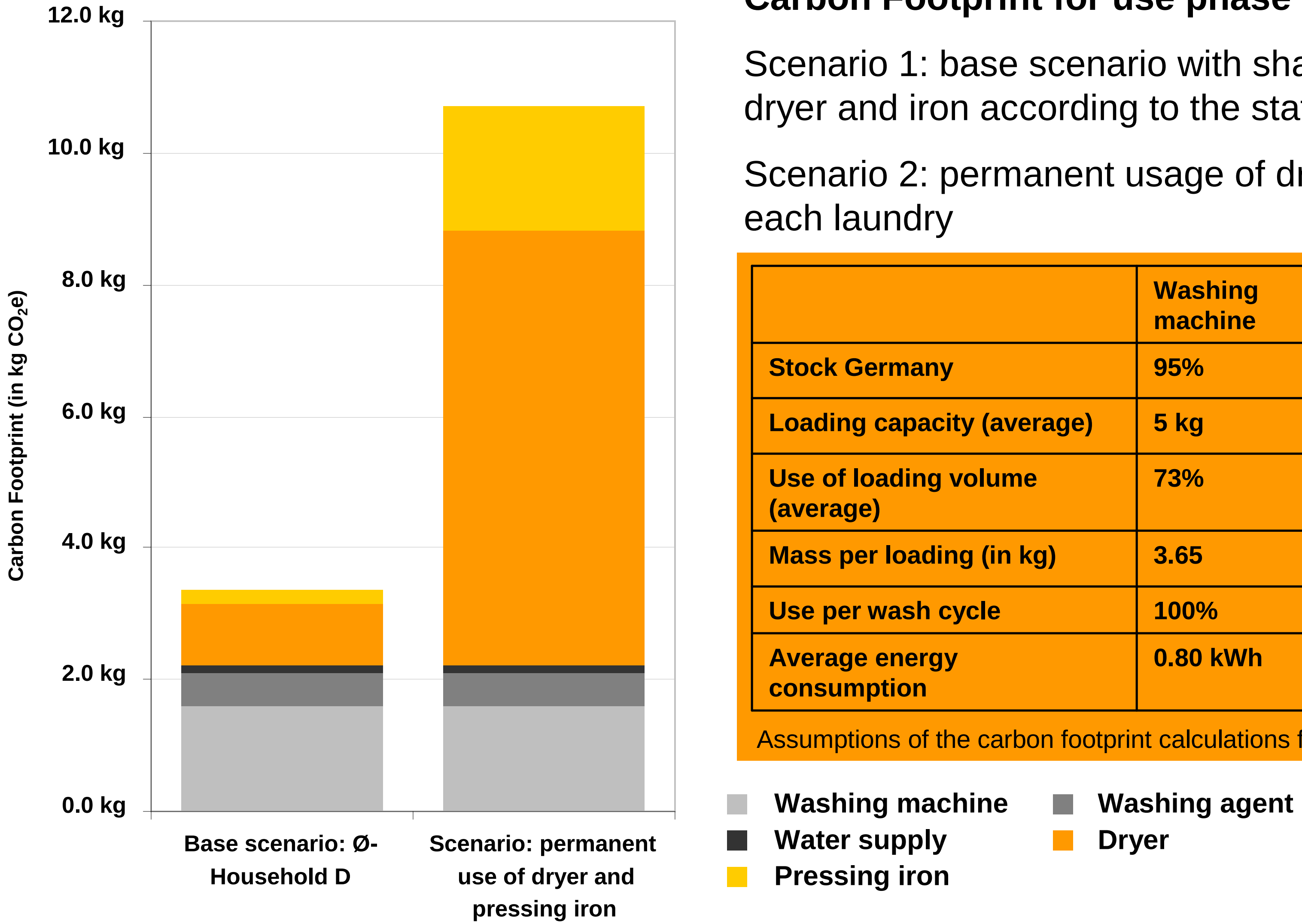
CO_2e-emissions in the production spinning – sewing/RMG (excl. transportation)

- Approx. 2/3 of the carbon emissions are caused by electricity, 1/3 by heating processes
- A major part of the electricity is generated on site (gas generators)
- High proportion of natural gas as source of energy
- Production of a dark longshirt (same size): 3.41 kg CO_2e

0.87 kg CO_2e are being emitted due to distribution processes, more than half result from returns



Consumers can contribute significantly to reduce the Product Carbon Footprint



Carbon Footprint for use phase (55 laundries)

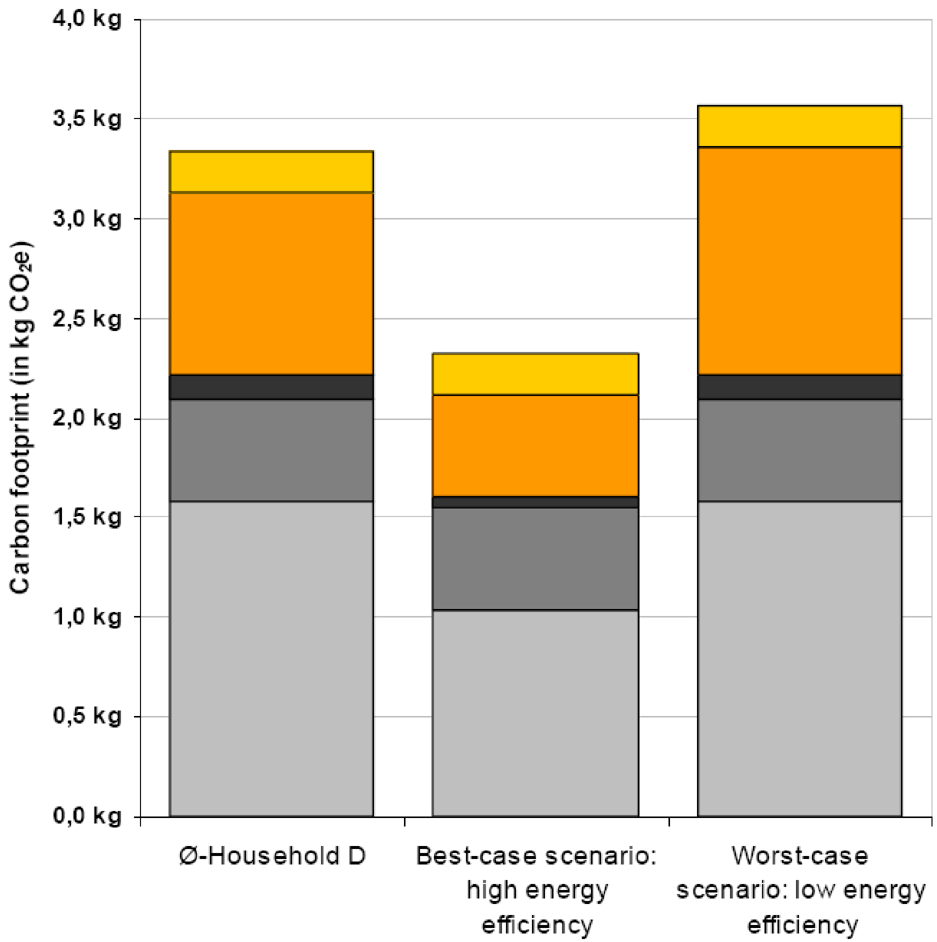
Scenario 1: base scenario with shared usage of dryer and iron according to the statistical average

Scenario 2: permanent usage of dryer and iron after each laundry

	Washing machine	dryer
Stock Germany	95%	36%
Loading capacity (average)	5 kg	6 kg
Use of loading volume (average)	73%	75%
Mass per loading (in kg)	3.65	4.50
Use per wash cycle	100%	17%
Average energy consumption	0.80 kWh	3.30 kWh

Assumptions of the carbon footprint calculations for the use phase

Options for reducing carbon emissions can be identified – example of energy efficient devices



Household devices with an improved level of energy efficiency may reduce the Carbon Footprint in use phase by one third, compared to the household stock.

The Carbon Footprint in the use-phase is further determined by:

- Washing temperature
- Actual loading of appliances

A washing temperature of 40°C instead of 60°C reduces the Carbon Footprint of the use-phase by 45%, 30°C instead of 40°C by 40%.

- **Washing machine**
- **Washing agent**
- **Water supply**
- **Dryer**
- **Pressing iron**

In total, three textiles have been evaluated

Long shirt ¾ sleeve, white
100% cotton

Size 40-42
Net weight 222 grams
Cotton from U.S.
Production in Bangladesh
Offered by OTTO

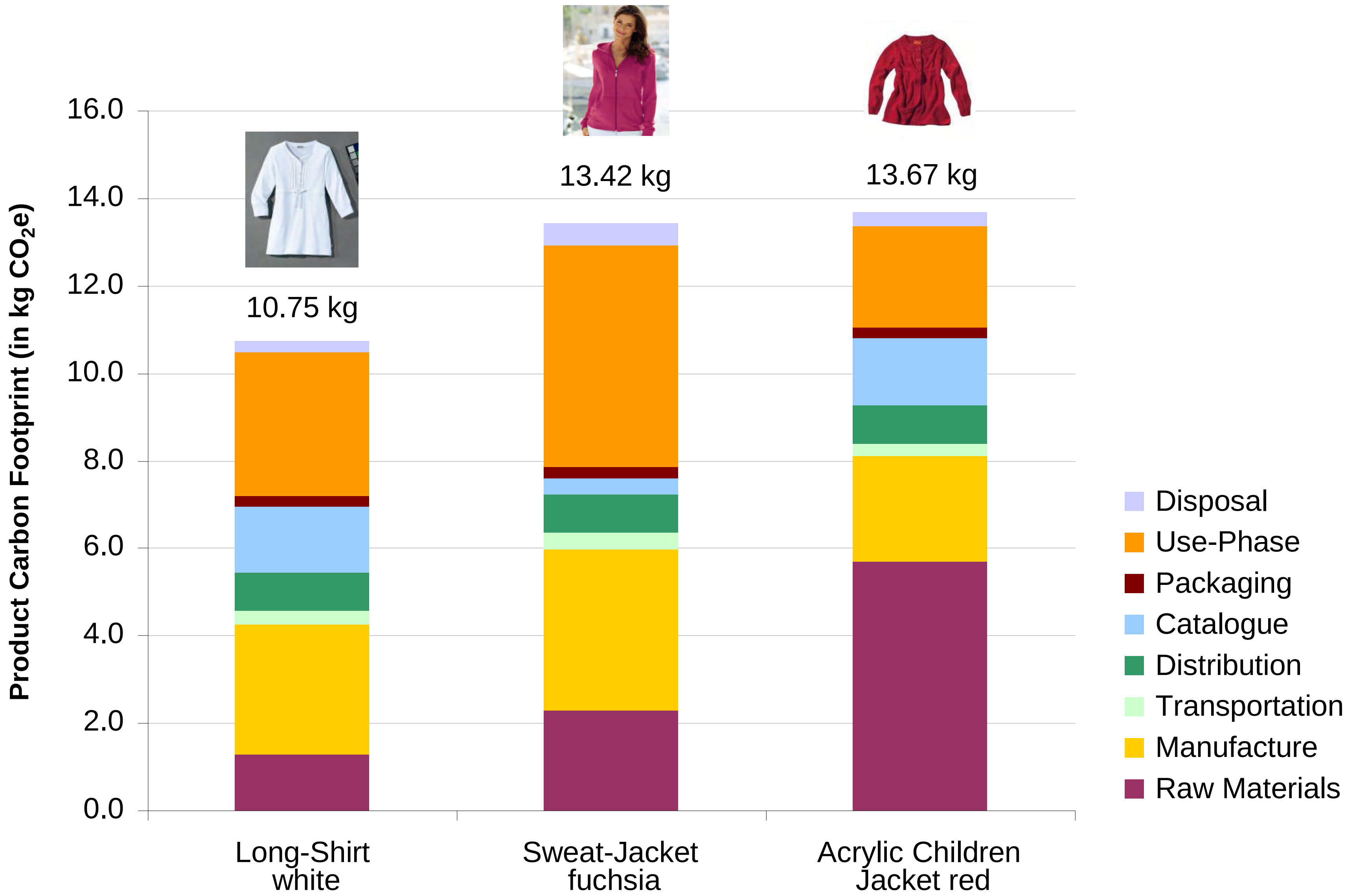
Sweat-jacket with hood, fuchsia
100% cotton ('Cotton made in Africa')

Size 40
Net weight 446 grams
Cotton from Benin
Production in Turkey
Offered by BAUR

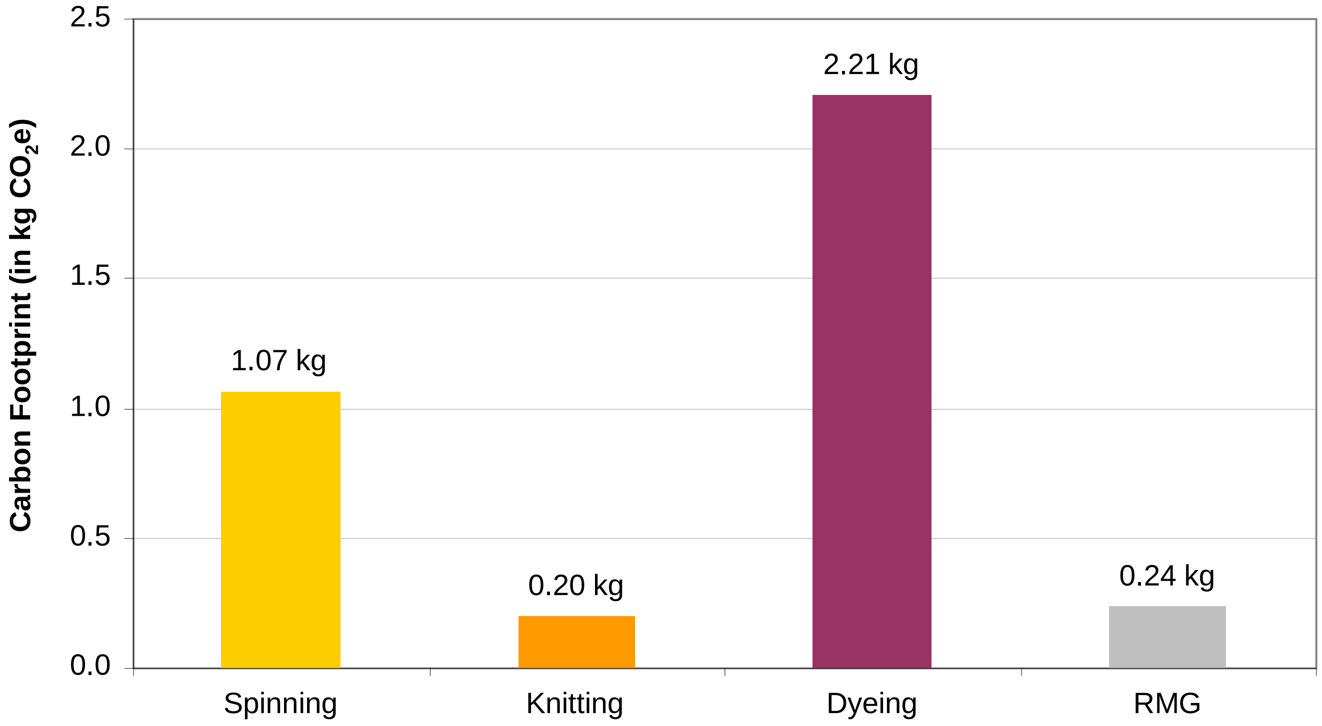
Jacket for kids, red 100% Acrylic

Size 152-158
Net weight 266 grams
Acrylic from China
Production in Bangladesh
Offered by OTTO

Three products - three Footprints – and lots of information



Energy efficiency and national grid factor reduce the carbon footprint in manufacture in Turkey

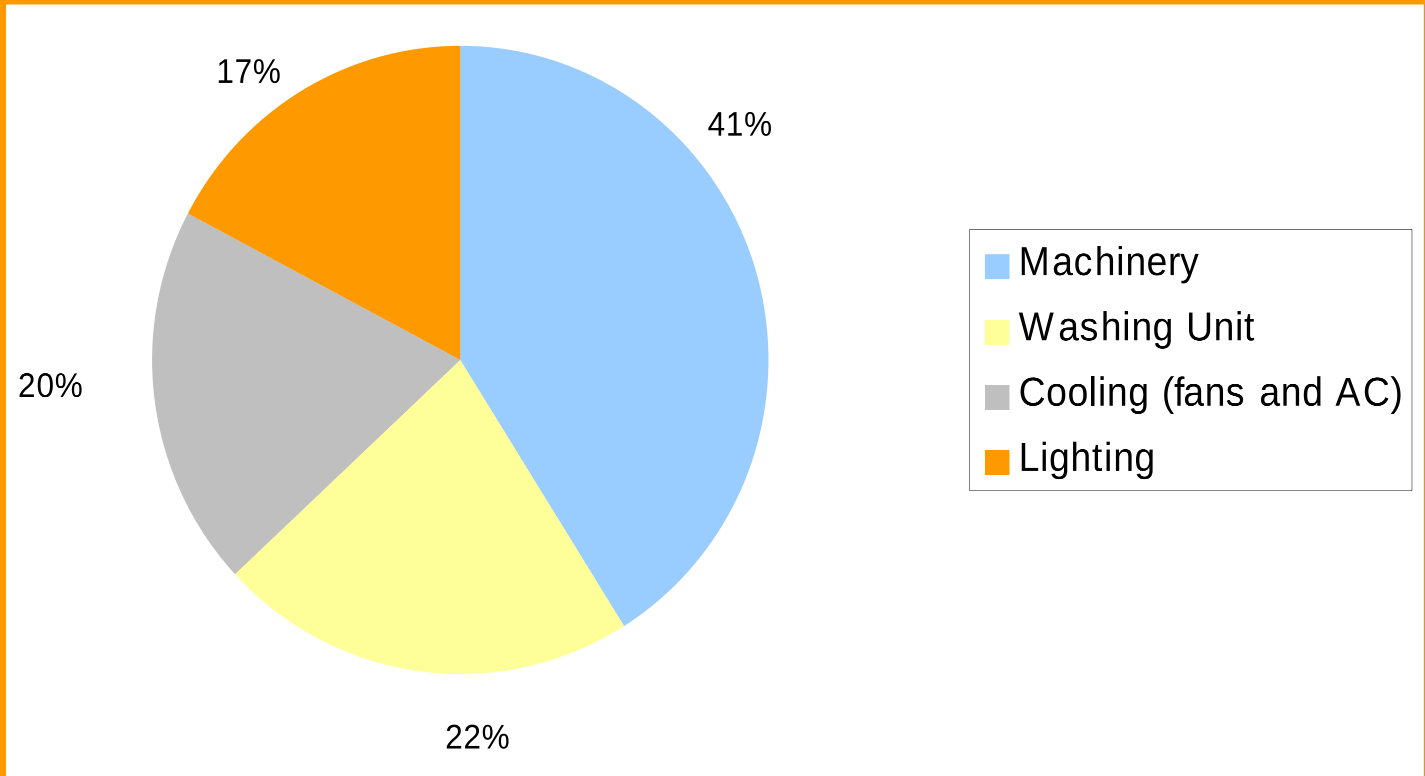


CO_2e-emissions in the production spinning - RMG (excl. transportation)

- 40% less GHG-emissions for manufacture compared to the longshirt produced in Bangladesh (mass equivalence)
- But 90% more GHG-emissions for dyeing due to: waste water treatment, color intensity, thickness of knit-fabric, energy sources (natural gas + lignite)
- Dyeing I: exclusive use of natural gas: 1.43 kg CO_2e; exclusive use of lignite: 2.30 kg CO_2e
- Dyeing II: elasticity of carbon footprint due to volatile production – doubling emissions per output

Cooling and Lighting have a significant quantity of electricity consumption in a garment factory

Analysis of electrical equipment



Percentage of electrical devices, clustered by electrical load (example garm,ent factory in Bangladesh – acrylic jacket)


Only low reflection of light by the ceiling
Inadequate reflectors
Tubes with less Watt would also be appropriate
Main switch instead of separate lights switchers
Too much tubes for lighting
Use of magnetic ballasts instead of electronic ones
Dark, light absorbing ceiling, walls and floors

Carbon Footprint results in transparency and raising awareness

Capabilities of the PCF:

- Creating **Transparency**
- Identification of **Hot-Spots**
- Determining **alternatives**
- Addressing carbon emissions **in the supply chain**
- Addressing carbon emissions in **emerging markets**
- **Awareness Raising**
- Using for **management instruments**

Incapabilities of the PCF:

- Not an exclusive eco-indicator
- No comparison by a CO_2-label
- No exact, universal result

Linking CO_2-emissions with energy costs is a key success factor

Four steps for a systematic approach

1. Orientation

- Are there regulations that may affect my business / -partners?
- What are expectations from our costumers, investors, the public?
- …

2. Transparency

- What is the carbon footprint of my company?
- Where can I find hot-spots for energy consumption?
- How much are the energy costs?
- …

3. Strategy

- What measures may reduce the energy consumption?
- What are short-term measures that can be taken immadiately?
- What are my investment costs?
- …

4. Implementation

- How can I implement the defined measures in existing processes?
- Who has to do what?
- How shall I communicate these measures?
- …

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