



Stitching department of a modern carbon-efficient Portuguese shoe factory.

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Reducing the carbon footprint

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Global warming, climate change and greenhouse gas emissions have now become terms of everyday life and topics of concern and discussion worldwide.

The drive for industrial and technological growth during the 20th century and the increase in greenhouse gas (GHG) emissions that accompanied it, have had a profound effect on our climate. But it is only more recently that we have begun to feel and understand the impacts and consequences of these climate changes. Now, new concepts such as 'sustainable growth', 'carbon economy' and 'carbon footprint' have entered our vocabulary.

As in every other manufacturing sector, companies in the footwear industry are faced with the challenge of reducing their carbon footprint both for the health of their business and that of the environment. CTCP has conducted a

research programme focused on estimating the Portuguese footwear industry's carbon footprint and establishing eco-efficiency strategies to cope with climate change and global warming through the use of better carbon management.

BACKGROUND

The last few decades have witnessed a rapid and intensive transformation of Portugal's footwear industry. In the 1980s, the conditions offered by Portugal in terms of proximity to large European markets and low production costs, combined with the finalisation of the single European market, attracted foreign investment that transformed the structure of the industry. The presence of large international companies and heavy investment by domestic manufacturers led to a rapid growth in production that reached a peak in the

mid 1990s.

The second half of that decade and the beginning of the new millennium brought big changes to the international footwear market. Removal of the last barriers to international trade and the addition of new members to the World Trade Organization decreased the competitive advantages that Portugal had previously enjoyed and caused many of the large international footwear companies that had set up in Portugal to relocate their operations to other parts of the world where production costs were lower.

Portuguese manufacturers responded to these new challenges with a profound restructuring of both their manufacturing capabilities and marketing strategies. Innovation, internationalisation and training were defined as the main pillars of the new approach. Companies that, in the past,

could only accept orders of thousands of pairs re-engineered their manufacturing processes to allow them to respond to orders for just a few. They now focused on fast response, fashion or functional products, advanced technologies and customer service. Many took up the challenge of making their way as fashion producers under their own brand names.

The resilience the Portuguese footwear industry has demonstrated during the recent serious economic international crisis shows this to have been the right course to take. The average export price has increased by more than 70% during the last 20 years reflecting the industry's focus on moving into greater value-added segments. Total quality, environment, sustainability, and social responsibility concepts were embraced and are being integrated in the global management.

EMISSIONS ESTIMATE

The initiative for the CTCF programme came originally from APICCAPS, the Portuguese footwear association. Although its members had performed well in recent years, it nevertheless wanted to identify areas where manufacturers could become more efficient, particularly in terms of energy usage and emissions reductions. It also reasoned that, as the subject was complex, any survey would need to be carried out by a national body such as CTCF which would have the necessary expertise and resources as well as detailed knowledge of the industry. The results would also be made available to all APICCAPS associated companies.

The research did indeed prove both difficult and time consuming as it initially called for in-depth analysis of existing legislation, recommendations and reports relating to the carbon footprint concept and relating them to the needs of the footwear industry. Needless to say, that comprised a considerable amount of documentation from organisations such as the WBCSD (World Business Council for Sustainable Development), WRI (World Resources Initiative), IPPC (United Nations Intergovernmental Panel on Climate Change), APA (Portuguese National Environment Agency) as well as many other papers and protocols.

The estimate itself was broken down into three aspects: 1-DE (direct



Kyaia uses energy efficient automatic cutting systems.

FIGURE 1: OPERATIONAL LIMITS

1 DIRECT EMISSIONS

- Production process: non-methane volatile organic compounds (NMVOC) emissions
- Stationary combustion: own production of heat, steam or electricity
- Mobile Combustion: own cars, trucks, forklifts, other - own vehicles combustibles consumed
- Emergency generators
- Refrigeration systems

2 INDIRECT EMISSIONS

- Electricity consumption

3 OTHER INDIRECT EMISSIONS

- Transport of raw materials to the company
- Transport of final product based on weight, distance and transport type
- Transport activities other: business travel of workers, other
- Effluents and waste treatment
- Water consumption
- Raw materials
- Packaging

FIGURE 2: TOTAL CO₂E EMISSIONS (INITIAL ESTIMATE)

Totals Carbon dioxide equivalent CO ₂ e (ton)				
	Source	Lower limits	Higher limits	Bibliography
1 - DE	Fossil combustibles	24,435.15	42,761.52	36,075.23 (A)
	Process (NMVOC)	4,364.20	4,959.32	8,926.77 (C)
2 - IE	Electricity use	17,480.54	26,220.81	22,923.19 (A)
3 - IE	Water use	146.65 (A)		
Other	Packaging	5,912.99 (B) or 92.9g CO ₂ e per pair		
	Effluents	50.20 (A)		
	Industrial waste	70.45 (A) assuming 100% landfill		
	Product transport	5,382.08 (Estimate)		
Total		57,842.26	85,504.02	79,487.56

Bibliography key for figures 1 and 2:

(A) Application of the Life Cycle Assessment of Footwear 1998.

(B) Pontifícia Universidade Católica do Rio Grande do Sul (Brazil) 2009 (materials).

(C) European Environment Agency 2009 (emissions).

**FIGURE 3: INDIRECT EMISSIONS
(ELECTRICITY CONSUMPTION) GHG EMISSION PER GAS**

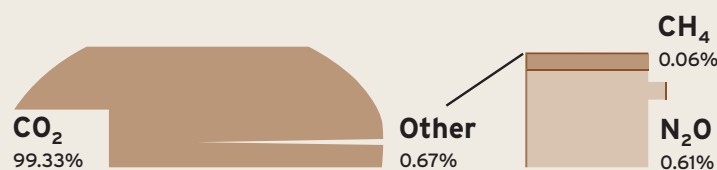
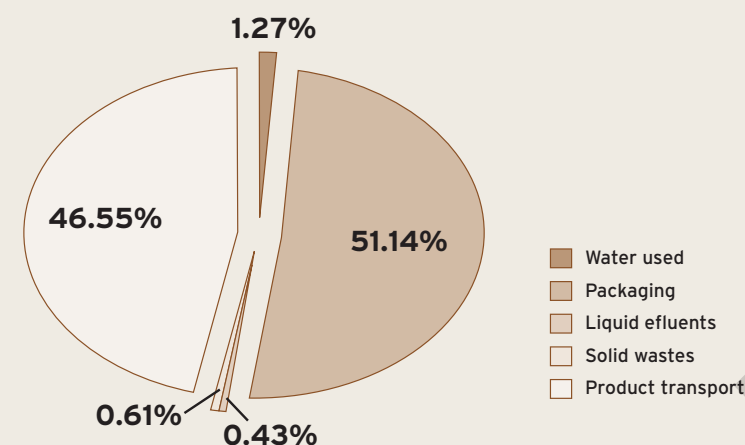


FIGURE 4: TOTAL ESTIMATED GHG EMISSIONS PER SOURCE



emissions), 2 - IE (indirect emissions due to electricity and 3 - IE (other indirect emissions). It was carried out based on data collected from 39 footwear producers plus additional published data A, B, C as detailed in Figure 2. These companies represented 11% of the industry's labour force and 12% of the total pairage produced. An initial estimate was made based on data from 2009 and then partially updated in 2013 with data from 2012. Figure 1 outlines operational limits for a typical footwear company.

The carbon inventory estimate is based on ranges of data collected in the 39 companies, thus the GHG emissions as total emissions of CO₂e are presented as lower and higher limits (LL and HL) respectively. Figure 2 shows the estimates obtained and for aspects 1 and 2 compares them with those reported in the relevant references. Based on these figures, it would appear that the Portuguese footwear industry in the LL limit area is already performing better than is reported for the global footwear industry in general.

DE represents 50% to 56% of total estimated GHG emissions, IE approximately 30% and other IE between 13% and 20%. With regard to the DE values, fossil combustibles due to own vehicles represents around 80% to 85% of the emissions while NMVOC due to

adhesives, finishings and other solvent-based products accounted for only 10% to 15%. Figure 3 shows GHG emissions per type of gas related to electricity consumption and, as would be expected, CO₂ represents over 99% of these.

Figure 4 shows the total estimated GHG emissions per type of source. According to the estimates made, packaging and final product transport, represent 51% and 47% respectively of the total. Materials GHG emissions were not included in this initial estimate but are nevertheless expected to be relevant, suggesting this area should be accounted for in a future step.

ECO EFFICIENT MEASURES

Comparing the number of pairs produced in 2009, the carbon footprint (total GHG emissions per pair) was in the range of 0.91 to 1.34kg CO₂e per pair. The footprint associated to DE combustibles and IE electricity ranged from 0.66 to 1.08kg CO₂e/pair. These indicators are in line with other estimations and show that companies in the LL perform better than that generally reported for the industry in general.

More recently and working within the framework of European project IEE/11/949/SI2.615946 IND-ECO (Industry alliance for reducing energy consumption and CO₂ emissions) partners from six European countries

are identifying the energy consumed by the footwear and leather sectors' industrial processes in order to find suitable eco efficient technical solutions and financial support initiatives with the object of reducing CO₂.

In the footwear sector the focus has been mainly directed on identifying and reducing emissions resulting from electricity consumption. The indirect emissions associated with electricity acquired per country were first estimated in 2013 based on 2012 data. Portuguese companies (75 checked) performed well and their carbon footprint in this aspect was in the range of 0.4 to 2.4kg CO₂e per pair. Furthermore, it would also appear that the companies that are actually in the lower range of the indicator are, on the whole, the same ones that participated in the 2009 study.

The study carried out so far has enabled us to identify a set of approaches and good management practices that can be followed by footwear companies to improve their energy efficiency and reduce their carbon footprint. The recommendations fall into four sections which are as follows.

Electrical energy management:

- Regular analysis of tariffs to find the best energy provider
- Contracted capacity correlated with the used
- Reactive energy control through the use of systems monitors
- Substitute magnetic ballasts by electronics
- Produce in lower cost periods (e.g. automatic nesting and cutting)
- Detailed analysis of consumption to identify potential improvements.

Compressed air:

- Careful planning and selection of equipment and systems
- Evaluate older equipment and consider replacement
- Adjust pressure to actual needs (7 down to 6 bar = 8% saving)
- Recovery of hot air produced for further usage
- Variable-speed drivers (VSD) to regulate motor speed
- Staff training and systems maintenance (e.g. reduce leaks).

Motors and equipment:

- Select high efficiency motors (HEM)
- Avoid over-sized systems and always

turn off when not in use

- Air input and ventilation (circular tubes and no curves)
- VSDs, staff training and systems maintenance.

Illumination:

- Natural light and pale colours wherever possible
- LEDs or compact fluorescent lamps to be preferred
- High pressure sodium or metallic iodine lamps instead of high pressure mercury
- Changing magnetic ballasts for electronic (classes A1 or A2)
- Automatic systems (e.g. photocells and motion sensors).



Efficient lighting systems and pale paintwork improve working conditions and reduce the carbon footprint.

The calculation of a product's carbon footprint is recommended on two counts. First, it can make the producer more cost- and environmentally-effective. Second, consumers are becoming better informed and, as a consequence, are increasingly seeking out products that can be shown to have had the least impact on the environment during their manufacture. The actual

results obtained are, however, dependent on the aspects considered and that the tools used to measure a product's carbon footprint are suitable.

As far as CTCP Portugal is concerned, this work is far from finished and more information needs to be collected, correlated and continuously updated in the future. The same will naturally apply to companies seeking to make

themselves increasingly efficient as regards their energy consumption and carbon footprints. As with every other aspect of business, it requires constant attention and review. And, even though it is yet a further call on management, it is one that should not be ignored; indeed, it is likely to become ever more important as the 21st century progresses. 🌀

