CRITIQUE OF THE LCA STUDY "*LIFE CYCLE ANALYSIS OF HAND DRYING SYSTEMS*" BY U. EBERLE AND M. MÖLLER (ÖKO-INSTITUT E.V., 2006)

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

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Executive Summary

Introduction

In 2006 the results of a study comparing the environmental performance, including GHG emissions, of cotton rolls and paper towels was published. The study was performed by the Ökoinstitut, commissioned by the European Textile Service Association (E.T.S.A.).

The conclusion of the study was that paper towels are the less preferable option for hand drying in washrooms. This conclusion however, is based on a number of assumptions that do not represent state of the art knowledge or can be challenged as an oversimplification. Once corrected the study conclusions are reversed.

Most obvious are the following aspects:

- **The average weight of a tissue towel**: In the Ökoinstitut study, an average of 4 g/sheet has been assumed. The European average as calculated from a survey among ETS members however is 2.48 g/sheet.
- **The number of pulls for cotton rolls**: The assumed 1 pull per hand drying in the illustrative summary of results represents the theoretical minimum and hence cannot be considered as an average[1]. This would assume that nobody would ever make two pulls, which is considered as an unrealistic assumption. Whilst some people might make only one pull, some people may make 2 pulls or more. In the absence of any quantitative information, conclusions can only be drawn on taking into account different behavior patterns. For instance we could assume that every second person makes 2 pulls (average of 1.5 pulls) or every third person is doing 2 pulls (average of 1.33 pulls).

Results

The following figure shows the Greenhouse gas numbers using the average weight based on a survey among ETS members of 2.48 g/sheet and different user behaviors.

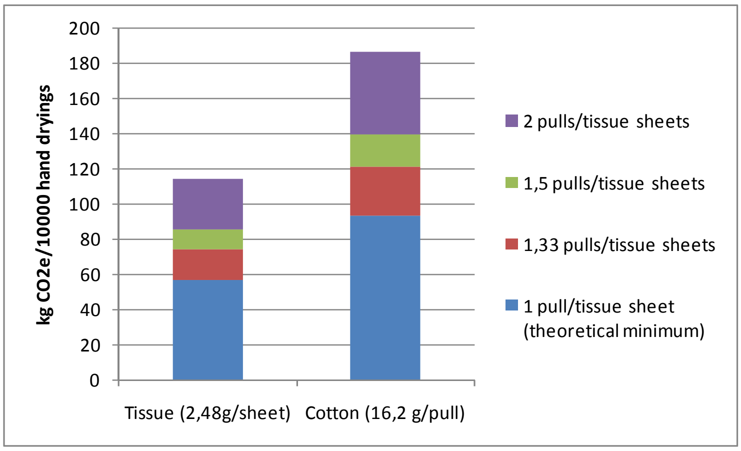

Figure 1: Greenhouse Gas Emissions (Carbon Footprint) for 10000 hand dryings (Functional Unit) using either tissue sheets (industry average) or cotton towel

[1] In fairness to the authors of the study it has to be noted that sensitivity in number of pulls has been performed, however the illustration of results is limited to one single case, assuming the theoretical minimum, which is an unrealistic case.

The figure reveals that

1. For the same number of pulls, the tissue towel shows clear advantages over cotton towel system
2. Assuming always two sheets of tissue are used, the cotton towel system is in the same range regarding GHG emissions once every third person is doing two pulls for cotton towels (average of 1.33 pulls)

Clearly, the carbon footprint cannot be regarded as the exclusive environmental criteria. In the Ökoinstitut study, results are discussed for seven indicators. Five of them are standard environmental impact categories. In the original study for all those five indicators, the cotton towel system shows lower emissions.

Correcting oversimplification and applying accurate tissue weights as described above, a completely different picture is gained. For four environmental indicators, the tissue solution now show lower environmental impact, as illustrated in the below figure.

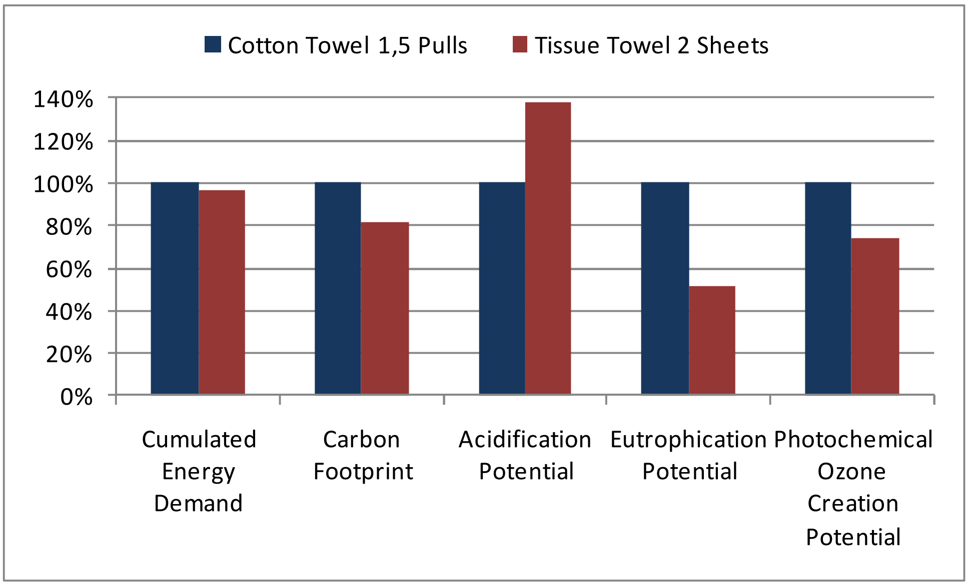

Figure 2: Results of correcting oversimplification and applying accurate tissue weights.

The indicators, waste and water as used in the original study are not necessarily comparable in respect to environmental relevance and hence should not be used as relevant environmental indicators defining the environmental performance. This is a fact that was already addressed by the reviewers of the original study[2].

Conclusions

The adjustment of the tissue paper weight shows clearly that the weight of the tissue towel is one of the significant parameters and therefore it should be ensured that this parameter

[2] See original Technical Report, Section Review Comments, page 111.

reflects reality[3]. Also, the assumption that nobody would ever make two pulls is considered as an unrealistic assumption.

Following the logic of the original study, more indicators in favor means the option is environmentally preferable, the conclusion of the original study are reversed when applying realistic assumptions. Four out of five indicators now are in favor of the tissue towel option. Considering additional uncertainties in other assumptions made in the Ökoinstitut study, the resulting differences between the two options cannot be interpreted in a way that promoting cotton hand drying systems will result in lower GHG emissions. The results clearly indicate that each system has its advantages and challenges when considering the environmental performance.

[3] The weight of the cotton towels is not as crucial as the weight of the tissue towels as the environmental performance of the cotton towel system is driven by the numbers of washing cycles (life time).

Additional Aspects

It should be noted, that this analysis is not to be considered as a formal review process according to ISO 14044. This has already been performed for the study. This section is about additional aspects which may have a significant influence on the results and hence the conclusions and have not been addressed in depth or at all in the study or critical review.

Life Cycle Inventory Data

Laundering - Energy and Water Consumption Representativeness

The calculations for the laundry are based on primary data of selected E.T.S.A members. Thus they should be considered of good quality. However, a comparison of the reported figures with the thresholds given in the Scandinavian ecolabelling scheme (Nordic Swan), reveals that the employed weighted average is much lower, a fact that has already been addressed by the reviewers of the original study. This also holds true if taking into account the stricter thresholds of version 2 (see the below table).

Table 1: Energy and water consumption figures as used in the E.T.S.A study and thresholds for the Nordic Swan. All figures are related to 1 kg cotton towel.

Values per 1 kg of Cloth hand towel rolls, threshold values			
	E.T.S.A. study	Requirements Nordic ecolabeling of laundries[1)]	
Criteria		version 1.2	version 2
Electricity	0,36 MJ/kg	< 3,6 MJ/kg	Total < 6,48 MJ/kg
Fuel	4,1 MJ/kg	< 7.2 MJ/kg	
Water	9,4 litres/kg	< 18 litres/kg	< 12 litres/kg

1) Nordic Ecolabelling: Ecolabelling of laundries, Criteria Document Version 1.2 and 2.

In the below figure we used the reported energy values to calculate the carbon footprint of the laundry processes. Clearly, even for the stricter thresholds of version 2, the E.T.S.A. figures are far below the carbon footprint obtained from energy consumption. The figure also demonstrates that the employed weighted average is very close to low end of the given range.

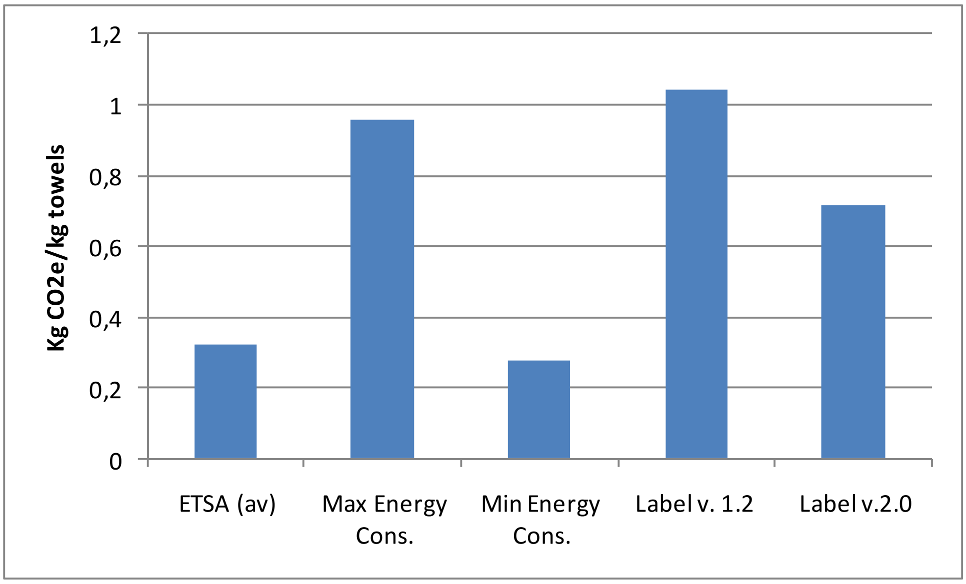

Figure 3: Comparison of the carbon footprint for laundries based on consumption figures as used in the E.T.S.A study and thresholds for the Nordic Swan.

These findings must not been interpreted to mean that the E.T.S.A. figures are not valid; As already stated in the review of the original study, E.T.S.A. laundries, are large laundries, with typically higher efficiencies compared to the average laundry. Also, in Nordic countries, thermal disinfection at higher temperatures is common practice, which is different in other European countries.

The question however remains with respect to representativeness of the final conclusions of the study.

Weight of cotton rolls

The weight of the cotton towels as used in this study maybe also considered as a source of uncertainty that was not addressed in the original study. The study reports a range for the weight of the tissue towels from 12.9 - 25.0 g/pull. (a factor of 0,8 -1,5). The weight used for all calculations in the study is 16.2 g/pull, representing the weighted average based on primary data collection

The weighted average, however, should not be considered as an appropriate average if no further information is given about:

- the share of considered sites on total E.T.S.A. member companies (laundries)
- the service volume covered by E.T.S.A members on total services offered.

In the absence of these information, a simple average measure would be preferable. Also, as stated above, this huge variation should have been addressed in a sensitivity analysis.

Cotton Supply Chain

The data provided by the Ökoinstitut study were taken from the master thesis Frydendal, 2001[4]. The data represent the world average of cotton growing (from land preparation up to ginning). Especially for the cotton roll production system (cultivation) the transparency of the employed data is poor, making it difficult to understand and interpret the results. Moreover, Jeppe Frydendal was selected as external expert to act as chairperson of the review panel. Since his master thesis is the only data source for the cotton production part this raises some questions with respect to the independency of the review.

Environmental Impacts

Exclusion of Land Use Changes for calculation of Climate Change (Carbon Footprint) indicator

The selected CML approach for the calculation of the Carbon Footprint can be considered as appropriate for the time the study was conducted. However, this approach does not account for land use changes (LUC), which are an important issue for agricultural based products such as cotton fibers. A guidance for the incorporation of land use changes in carbon footprint calculations is now available with PAS 2050. According to this guidance, land use change impacts are focused on the calculation of net changes in carbon pools (aboveground biomass, litter and mineral and organic soil). Usually LUC has a high impact on the GWP of agricultural products. According to PAS 2050 Greenhouse Gas emissions due to Land Use Changes has to be considered if the product's supply chain directly caused non agricultural land to be converted to agricultural use on or after 1 January 1990 (see PAS 2050 Section 5.5). As Land Use Changes cannot be ruled out an estimate for a cotton crop cultivated in China should be performed.

In fairness to the authors of the study it has to be noted that during the timeframe when the study was performed and present, the methodology on incorporating Land Use Changes in the carbon footprint has advanced considerably.

Erosion for cotton production

Erosion is a widely discussed aspect in cotton cultivation.. Impacts associated with erosion usually are not considered separately in LCA studies. Nevertheless erosion of surface soil can have an effect on traditional impact categories like eutrophication as nutrients stored in the soil (NH4-N, NO3-N, P2O5) were eroded with the soil to surface water. These impacts should be addressed within the scope of a study with cotton as one of the main products.

[4] Frydendal, J.; Life Cycle Assessment of Berendsen Care Bed Pads. Part of Master Thesis at Department of Manufacturing Engineering, Technical University of Denmark. 2001

Glossary/Abbreviations

Acidification Potential	Acidification potential is the result of aggregating acid, expressed in SO2 equivalents. The AP is an important environmental indicator. Acidification potential translates the quantity of emission of substances into a common measure to compare their contributions to the capacity to release hydrogen ions. Acidification originates from the emissions of sulphur dioxide and oxides of nitrogen. In the atmosphere, these oxides react with water vapor and form acids which subsequently fall down to earth in the form of rain or snow, or as dry depositions.
Eutrophication Potential	Index used to measure nutrient enrichment (eutrophication), which may result in algal blooms, caused by the release of sulphur, nitrogen, phosphorous and degradable organic substances into the atmosphere and water courses.
Cumulated Energy Demand (CED)	Cumulative Energy Demand (CED), concerned with the primary energy-efficiency, is often used as an indicator for the environmental performance of products and processes.
Photochemical Ozone Creation Potential	Photochemical ozone or ground level ozone is formed by the reaction of volatile organic compounds and nitrogen oxides in the presence of heat and sunlight. Ground-level ozone forms readily in the atmosphere, usually during hot summer weather. Photochemical ozone creation potential translates the quantity of emission of gases into a common measure to compare their contributions - relative to ethylene - to the formation of photochemical oxidants. Measured in kg C2H4- Equivalent.
Greenhouse Gas Emissions (GHG)	Most important emissions are carbon dioxide, methane, nitrous oxides.
CO_2	Carbon Dioxide
Land Use Change (LUC)	Land Use Change has considerably impacts on the global carbon cycle and as such these activities can add or remove carbon dioxide from the atmosphere. Land Use Change has been the subject of two major reports by the Intergovernmental Panel on Climate Change (IPCC).