



Report to ETSA

Assessment of global warming potential of two textile services

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0. Introduction

Climate change due to emission of greenhouse gases presents a serious challenge for responsible business leaders in the 21st century. Most scientists now agree that rising atmospheric concentrations of greenhouse gases (GHGs), particularly carbon dioxide (CO₂), will have a serious impact of many activities of societies and natural ecosystems around the globe. Besides an overall increase in temperature, these impacts may include more intense rainfall, storms, flooding, drought, an increasing sea level, etc.

The European Textile Services Associations (ETSA) and its member companies are committed to contributing to the reduction needed in the coming years. ETSA, therefore, has asked EcoForum (Denmark) to support it in establishing a methodology for calculating the potential global warming impact of two key services:

1. Providing one worker with workwear for one year, and
2. Providing one hotel bed with linen for one year.

This report summarises the methodology applied and presents the result of this first assessment.

1. Executive summary

This report presents a methodology to estimate the emissions of greenhouse gases from two major textile services provided to customers in Europe: workwear and hotel linen. The results of the industry's first assessment are also presented here.

For these two services, the following functional unit has been identified:

3. Providing one worker with workwear for one year, and
4. Providing one hotel bed with textiles for one year.

The data collection and presentation in this report is performed according to the principles stated in the methodology of the WBCSD/WRI Greenhouse Gas Protocol.

The assessment is based on two surveys performed by ETSA for their member companies:

- The first survey covered resource consumption – **oil/gas/diesel, electricity, detergents and water** – in the laundries supplying the two services covering their total consumptions for 2011. This survey included nine ETSA member laundry groups, with a total of 96 laundries dedicated to providing workwear and 63 laundries dedicated to hotel linen. Geographically, this survey covered most of Europe.
- The second survey determined the **average supply of laundering services** to provide the two services, including the **average purchasing of new textiles**. This survey covered six ETSA member companies with respect to workwear and five member companies with respect to hotel linen supply. Together these six member companies supply textile services to most of Europe.

Hence, the assessment includes all energy uses (scopes 1 and 2 according to the Greenhouse Gas Protocol) for the textile service activities including laundering and transport/distribution of clean/dirty textiles, plus the supply of detergents, new textiles and water/wastewater treatment in scope 3. Due to lack of reliable data, the assessment does not include the disposal of end-of-life textiles.

By applying of the appropriate emission factors, or estimates of the emissions, the average consumption figures are converted to estimates of the global warming potential (GWP). This is expressed as "CO₂ equivalents" or "CO₂ eqv". The table below presents the estimated GHG emissions for scope 1, 2 and 3, for the two services assessed.

Total estimated GHG emissions from the two services assessed:

	Workwear	Hotel linen
Scope 1	kg CO₂ eqv per service unit	
Consumption of fuel for heating	16,1	41,8
Consumption of fuel for distribution	4,9	7,5
Scope 2		
Electricity consumption	5,1	12,1
Scope 3		
Supply of detergents	4,1	6,4
Supply of textiles	15,1	21,3
Water supply /wastewater treatment	0,3	0,6

Total	46	90
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The differences in estimated emissions from the two services can be explained by the underlying assumptions stated in section 3 of this report.

The average amount of textiles laundered (and distributed) for the service provided is 51 kg for workwear and 157 kg for the hotel. These volumes relate to scope 1 and 2, plus the consumption of detergents and water in scope 3 (see page 4).

The average amount of new textiles purchased are 1,1 kg for workwear and 1,5 kg for the hotel. These volumes relate to the supply of textiles in scope 3 (see page 4).

The sensitivity analysis shows the robust nature of the methodology and impact figures and assumptions used here.

The results of this assessment illustrate that the impact of supplying new textiles is many times higher than the impact of washing these textiles once.

Despite the limitations of this study, it is judged that the results of 46 kg CO₂ eqv and 90 kg CO₂ eqv provide a reasonably robust estimate of the global warming impact of the two services provided. This is in particular because all input numbers are averages for a significant number of companies/plants.

EcoForum

Henrik Grüttner

April 2015

2. Greenhouse Gas Protocol (GHG) approach

2.1 General procedure

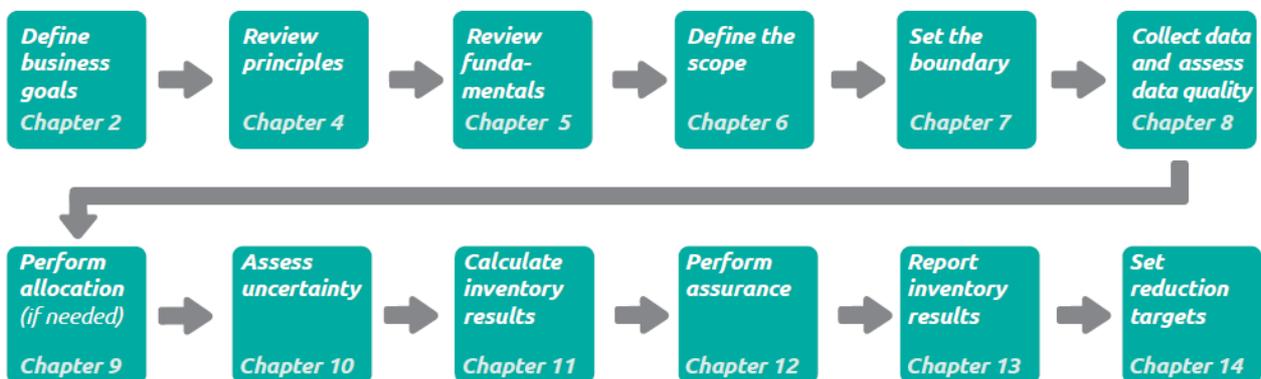
The assessment methodology used here aims to follow the reporting principles and guidelines provided by the Greenhouse Gas Protocol published by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) – known as ‘the GHG Protocol’. In particular, the Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard¹ has served as a reference for the work.

This standard provides a lot of relevant and inspiring information, but is specifically targeted at manufacturing industries with a specific physical product. In the context of textile services we are assessing a ‘service product’. Hence, certain adaptations and modifications have had to be included in the work.

Furthermore, the methodology aims to follow the principles outlined in the ISO standard 14064-1 ‘Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals’².

The Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard (named ‘GHG Product standard’ in the following) provides a recommended methodology as summarised in figure 1.

Figure 1: Overview of the requirements of the Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard



In line with the reference documents mentioned, EcoForum has used the following procedure to undertake the Climate Change Impact Assessment for the two services assessed:

- Define business goals
- Review principles and fundamentals
- Define the scope for the assessments

1 <http://ghgprotocol.org/standards/product-standard>

2 Reference number: ISO 14064-1:2006.

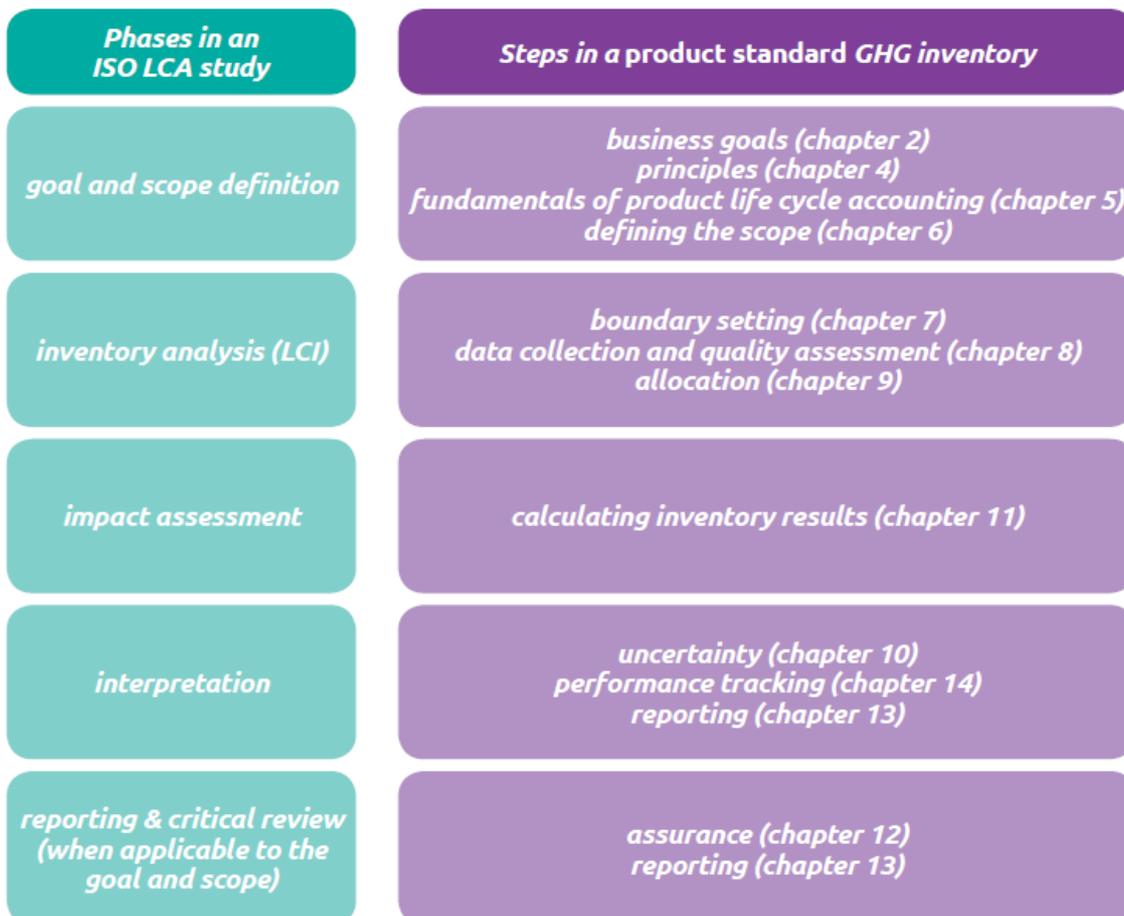
- Establish the assessment boundaries
- Collect client data
- Evaluate data quality and client data sources
- Assess uncertainties
- Calculate inventory results
- Analyse results
- Determine suitable recommendations for future actions and reduction targets

The assessment procedure and a summary of results are presented in the following text of this report.

No third party control has been included for quality assurance. However, it must be stressed that EcoForum has no commercial interests of any kind in the textile services business – except for providing consultancy service to ETSA and some of its member companies.

Furthermore, it is important to stress that despite a number of similarities between on the one hand life-cycle studies following the ISO LCA standards 14040 and 14044, and, on the other hand, the Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard, they cannot be considered equal. Figure 2 outlines some of the overall differences in terminology and approaches.

Figure 2: Comparison between the phases of an ISO LCA study and the steps of a Product Standard GHG inventory (source: the GHG Product standard).



2.2 Definition of business goals

The GHG Product standard recommends that businesses identify their business goals related to the product assessment initiatives. The standard further provides a long-list of possible goals – see figure 3.

Figure 3: GHG Product standard list of business goals

Business goal	Description
Climate change	<ul style="list-style-type: none"> • Identify new market opportunities and regulatory incentives • Identify climate-related physical and regulatory risks in a product's life cycle Assess risks from fluctuations in energy costs and material availability
Performance tracking	<ul style="list-style-type: none"> • Focus efforts on efficiency improvements and cost-saving opportunities through GHG reductions throughout a product's life cycle • Set product-related GHG reduction targets and develop strategies to achieve goals
Supplier and customer stewardship	<ul style="list-style-type: none"> • Partner with suppliers to achieve GHG reductions • Assess supplier performance for GHG aspects of green procurement efforts <ul style="list-style-type: none"> • Reduce GHG emissions and energy use, costs, and risks in the supply chain and avoid future costs related to energy and emissions • Launch a customer education campaign to encourage actions
Product differentiation	<ul style="list-style-type: none"> • Achieve competitive advantage by pursuing GHG reduction opportunities and cost savings to create a low-emitting product • Redesign a product to better respond to customer preferences • Strengthen brand image regarding GHG performance <ul style="list-style-type: none"> • Enhance employee retention and recruitment resulting from pride in product stewardship

The main incentives for ETSA and its member companies in preparing the product assessments presented in this report have been related to 'product differentiation', in particular to:

- Strengthen the textile services image regarding GHG performance
- Strengthen the reputation and accountability of textile services through public disclosure

Many of the other goals mentioned are considered background incentives, being particularly relevant for the member companies.

2.3 Principles and fundamentals

According to the standard, GHG accounting and reporting of a product inventory shall follow the principles of relevance, accuracy, completeness, consistency, and transparency – see further details in table 1.

Table 1: Key principles of GHG accounting and reporting of a product inventory as stated in the GHG Product standard.

Relevance	Ensure that the product GHG inventory accounting methodologies and report serves the decision-making needs of the intended user. Present information in the report in a way that is readily understandable by the intended users.
Completeness	Ensure that the inventory report covers all product life cycle GHG emissions and removals within the specified boundaries; disclose and justify any significant GHG emissions and removals that have been excluded.
Consistency	Choose methodologies, data, and assumptions that allow for meaningful comparisons of a GHG inventory over time.
Transparency	Address and document all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the methodologies and data sources used in the inventory report. Clearly explain any estimates and avoid bias so that the report faithfully represents what it purports to represent.
Accuracy	Ensure that reported GHG emissions and removals are not systematically greater than or less than actual emissions and removals and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable intended users to make decisions with reasonable assurance as to the reliability of the reported information.

In this report, these principles are dealt with in the following ways:

Relevance

Traditionally consumption figures and CO₂ impact figures have been expressed per kilo of laundered textiles, since this is the unit used by the laundering business for internal reporting and performance assessment. This unit has limited meaning for the clients who actually purchase the service of providing one worker with a specific set of clean textile items delivered at a specified frequency, for example.

By defining a ‘service unit’ – the functional unit for the assessment – the results become relevant to the textile clients.

Completeness

The present report is the first attempt to prepare a product CO₂ footprint covering scope 1, 2 and 3. With respect to scope 3, this study must be seen as a first iteration applying available literature data in order to assess the magnitude and importance of the textile supply, the supply of detergents and the supply of water treatment. As stated in the recommendations section, the data for the scope 3 impacts should, in fact, be more closely related to the actual performance of the suppliers, and ETSA is encouraged to establish such cooperation with the suppliers in the future.

Consistency

Except for the literature data for scope impacts, all data originate from the operational statistics managed by the ETSA member companies. In particular for the consumption figures for water, energy and detergents, a practice for registering and handling has been developed over the last 10-15 years. Regular WECO surveys

are carried out by ETSA for the industry. The latest consumption figures were collected during the 2012 survey (with 2011 data), and it is planned to repeat the survey in 2016 (with 2015 data).

Transparency

Laundering is a well-known process and as illustrated in the next section, this assessment aims to address all relevant issues related to the operation of industrial laundering. Again it has to be stressed that this is the first iteration and hence there is room for progress, and the strengths and weaknesses of the assessment are clearly stated in the relevant sections of the report.

Accuracy

Due to the fact that the different consumption figures used for the assessment are based on operational statistics of the member companies, it is confirmed that these data represent the actual performance of the companies taking part in the surveys. To the knowledge of EcoForum, no selection of figures representing ‘good’ or ‘bad’ performance has been included in the data surveys.

2.3 Scope and boundaries of product inventory

According to the GHG Product standard the inventory shall follow the life cycle and apply attributional approaches.

This report presents the assessment of two services, each defined as a service unit or a functional unit:

- Providing one worker with workwear for one year, and
- Providing one hotel bed with linen for one year.

These service units are further detailed in section 3.1.

In both cases, the inventory must cover a number of life-cycles as shown in table 2.

Table 2: Overview of the life-cycles included in the textile services assessed

	Raw-material stage	Manufacturing stage	Use stage	Disposal stage
Textiles	Growing of cotton Extraction of crude oil and refining into polyester	Spinning Weaving Wet treatment Cutting and stitching	Use in textile services	<i>Not considered</i>
Detergents	Extraction of the relevant raw-materials	Manufacturing the industrial detergents	Consumptions in textile services	Discharge to municipal wastewater treatment plants – together with the soiling
Water	Extraction	Pre-treatment typically ‘softening’ by ionic exchange	Consumptions in textile services	
Electricity	Extraction of oil, gas, etc.	Manufacturing and distribution of the electricity	Consumptions in textile services	(Energy lost as heat)
Fuels like Oil/gas/diesel	Extraction of oil, gas, etc.	Refining Distribution	Consumptions in textile services	(Energy lost as heat)

Except for the disposal at the end-of-life of textiles, the assessment includes the impact of all these elements. The reason is that the allocation of the end-of-life textiles to the different disposal options is not sufficiently clearly mapped at the present time.

In particular for workwear, some laundries have on-site wastewater treatment plants. In those cases, the consumption of electricity for operation is included in scope 2.

Naturally textile services companies also make use of equipment, buildings, vehicles. The impact of manufacturing and disposal of this is omitted from the assessment, since other studies show that the impacts of such are negligible, compared to the use stage.

2.4 Reporting approach: Consumptions

EcoForum recommends a methodology based not on direct measurement of emissions, but on estimates of material and energy consumption (principally weight or volume of fuel) from which estimates of emissions can be derived, by the application of relevant emission factors (i.e. amount of CO₂ equivalents produced per unit of fuel consumed). This approach is considered the most pragmatic, since the quantity of key greenhouse gases produced in most combustion and manufacturing processes is well understood.

The validity of all estimates depends on the accuracy, relevance and completeness of the data provided by the client and on the emission factors used. EcoForum’s approach is to set out as clearly as possible all the assumptions and emission factors used so that the report is as transparent as possible, and the estimate of the GHG emissions are founded on 'best evidence'. The consumptions included in the assessments are further specified in table 3.

Table 3: Specification of the consumptions covered by the applied methodology

Consumptions	Covering	Scope	Data validity*
Energy inputs	Fuel consumption for:		
	- production (washing & drying)	1	R
	- heating of buildings	1	R
	Electricity		
	- production (washing & drying)	2	R
	- lighting, etc. in buildings	2	R
	- on site wastewater treatment	2	R
Fuels for transport	Company owned vehicles		
	- trucks and lorries for distribution	1	R
Supply of textiles	Amount of new textiles purchased	3	E
	Impacts - see details in section 3.3		
Supply of detergents	Amount of detergents used to provide the services		
	- average consumption	3	R
	Impacts - see details in section 3.4		
Supply of water / wastewater treatment	External water treatment		
	- water consumption	3	R
	- water discharge	3	E
	Impacts – see detail in section 3.5		

* R = registered data / E = estimated data

It has to be mentioned that fuel for transport is considered scope 1, even though some of the member companies outsource part of their transportation.

2.5 Emission factors for energy

In order to establish the amount of CO₂ equivalent emitted from energy consuming activities, default emission factors were applied. These were taken from the World Resource Institute (2009): GHG Protocol tool for stationary combustion (version 4.0): 'Calculation tool for direct emissions from stationary combustion' (2009). The emission factors applied are listed in Table 4.

Table 4: Emission factors for the sources of energy applied in the calculations

Energy source	Factor	Unit	Reference
Electricity	0,385	kg CO ₂ -eqv/kW	Nordic Eco-labelling Council
Natural gas	0,202	kg CO ₂ -eqv/kW	GHG, WRI 2011
Light fuel oil	0,264	kg CO ₂ -eqv/kW	GHG, WRI 2011
Diesel	2,68	kg CO ₂ -eqv/l	GHG, WRI 2011
Gasoline	2,27	kg CO ₂ -eqv/l	GHG, WRI 2011

The applied emission factors should always be selected in a way that assures the best representation of the actual situation. In reality, the emission factors are impacted by a long list of aspects, and in the longer perspective, it is recommended to require the specific emission factors for the specific fuels from the suppliers.

EcoForum recommends using a marginal consideration of all energy sources. For this reason, the European factor is selected as the conversion factor for electricity. The figure chosen is presented by the Nordic Ecolabelling Council and represents total Europe around 2010³.

The methodology applied here expresses the global warming potential (GWP) as CO₂ equivalents – see explanation in the box below.

Greenhouse gases – Overview

A Climate Change Impact Assessment can include all six greenhouse gases covered by the Kyoto Protocol. The six Kyoto gases are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulphur hexafluoride (SF₆), perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs). Alternatively the global warming potential (GWP) of each greenhouse gas may be expressed in CO₂ equivalents (see table below). For those gases with a high global warming potential, a relatively small emission can have a considerable impact.

The global warming potential of the Kyoto gases

Kyoto gas	GWP ⁴
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	23
Nitrous oxide (N ₂ O)	296
Sulphur hexafluoride (SF ₆)	22,200
Perfluorocarbons (PFCs)	4.800 – 9.200
Hydrofluorocarbons HFCs)	12 – 12.000

³ Nordic Ecolabelling of Textile services, version 3.2, 22 October 2014 -

http://www.ecolabel.dk/kriteriedokumenter/075e_3_2.pdf

⁴ The global warming potential' GWP of a gas is its relative potential contribution to climate change over a 100 year period, where CO₂ = 1, as defined by IPCC (2001).

3 Data collection – sources and quality assessment

The fundamental assumption underlying this assessment is that all data provided by the ETSA member companies are accurate. No tracking or review of the data handling inside the member companies has been performed.

The sources of data for this assessment are two surveys performed by ETSA for their member companies:

- The first survey covered resource consumptions – **oil/gas/diesel, electricity, detergents and water** – in the laundries supplying the two services, covering their total consumptions for 2011.
- The second survey determined the **average supply of laundering** and **purchasing of new textiles** to provide the two services.

3.1 Supply of textiles and laundering – defining the functional units

In order to define the average supplies of laundering and new textiles included in the two services considered, the survey presented in annex 1 was performed.

The survey had the aim to determine the amount of laundering and the amount of new textiles required to:

- Provide one worker with workwear for one year, and
- Provide one hotel bed with linen for one year.

The survey covered six ETSA member companies supplying workwear service to their clients and five member companies supplying hotel linen. Together these member companies supply textile services to most of Europe.

The key results of the survey are shown in table 5.

Table 5: Average supplies for the two services

	<i>Volume of laundering (kg/year)</i>	<i>Number of new textile items required*</i>	<i>Weight of new textiles - cotton (kg/year)</i>	<i>weight of new textiles - polyester (kg/year)</i>	<i>Weight of new textiles - total (kg/year)</i>
Workwear	51	2,41	0,47	0,64	1,11
Hotel linen	157	2,40	1,12	0,33	1,46

* See detail in annex 1.

The blue numbers in table 5 define the key supplies in the services provided, to be used for further calculations.

The volumes of laundering are multiplied by the consumption figures stated in section 3.2 and the relevant emission factors, and the weight of new textiles are multiplied by the CO₂-impact figures presented in section 3.3.

Naturally, some minor variations between the member companies were found in the survey, but overall the average figures presented in table 5 provides a good illustration of the typical supplies associated with the two services.

3.2 Consumption figures for the laundries

In order to determine the consumption of energy, detergents and water to provide the volume of laundering stated in table 5, the consumption figures from the ‘WECO survey 2011’⁵ for workwear and flat linen are applied.

This survey included nine ETSA member laundry groups with a total of 96 laundries dedicated to providing workwear and 63 laundries dedicated to hotel linen. Geographically this survey covered most of Europe.

The average figures identified in the WECO survey are shown in table 9.

Table 6: Overview of the main results of the 2011 WECO-survey. Table shows weighted average figures for all plants.

2011 survey, average for all plants	Units	Workwear, 2011		Flat linen, 2011	
		Weighted average	Number of plants	Weighted average	Number of plants
Water per kg	l/kg	14,4	96	10,6	63
Electricity per kg	kWh/kg	0,28	96	0,21	63
Detergents per kg	g/kg	37	81	17,9	43
Oil/gas per kg	kWh/kg	1,46	96	1,18	63
Distribution:					
Diesel per kg laundry	l/kg	0,04	26	0,02	29

Typically the laundries register the consumption of fuel for heat production, electricity consumption, consumption of water and laundry detergents and the washed kg laundry on a monthly basis and report these figures to the headquarters of the member companies. Hence, it is judged that these figures quite accurately represent the average consumption of the relevant European laundries.

3.3 Impact of textile supply

The impact of textiles supply is assessed by application of literature data. A review paper surveying 30-40 papers/reports have been used as the sole source of data⁶. Table 7 and 8 presents the average impact data provided in this paper for polyester fabric and cotton fabric respectively.

According to the authors, these figures represent the present state of knowledge on the impacts of textile production, but great variations are seen. Hence, it cannot be judged to what extent they represent the situation for the suppliers of the ETSA members.

It is strongly recommended that ETSA member suppliers are encouraged to provide data for their supply chain based on the GHG Product Standard for application in future assessments.

⁵ ETSA Survey on resource consumption in workwear laundries and flat linen laundries in 2011 – ‘WECO 3’ – FINAL, 8 January 2013, Prepared by EcoForum / Henrik Grüttner for ETSA.

⁶ N.M. van der Velden et al. 2013: LCA benchmarking study on textiles made of cotton, polyester, nylon acryl, or elastane. (In Int J Life Cycle Impact Assess, Sept. 2013)

Table 7: Average CO₂ impacts of polyester fabric manufacturing

CO ₂ impact of polyester fabric	kg CO ₂ eqv per kg fabric
Polymer pellets	2,7
Extruder spinning	0,9
Texturing	0,5
Weaving*	5,0
Dyeing	2,2
Heat setting, etc.	0,9
Sum	12,2 kg

* Spinning and weaving depends significantly on the decitex. Here 150 dtex is applied.

Table 8: Average CO₂ impacts of cotton fabric manufacturing

CO ₂ impact of cotton fabric	kg CO ₂ eqv per kg fabric
Cotton fibres, ginned, at farm	3,5
Pre-treatment	1,3
Spinning*	3,4
Weaving*	5,0
Dyeing	2,2
Sum cotton	15,4 kg

* Spinning and weaving depends significantly on the decitex. Here 150 dtex is applied.

3.4 Impact of detergent supply

The impact of manufacturing the detergents applied for industrial laundering has been provided by one of the key suppliers - Ecolab⁷ - see table 9.

For the most commonly used products applied in the industry, the CO₂ impacts have been estimated at 2.37 kg CO₂ eqv/kg. Hence, this figure is applied to the assessment.

Table 9: Data for impacts of detergents for industrial laundering, provided by Ecolab 2012

Product	Emission factors kg CO ₂ eqv / kg product
Basis Detergent, Powder	2,37
Basis Detergent, Emulsion	2,37
Disinfection Agent	1,38
Surfactant Booster	2,37

⁷ CARBON FOOTPRINT OF LAUNDRY PROCESS: DETERGENTS, Ralf Erbo Knob, Ecolab, presentation at ETSA Environment Steering Committee, 21 March 2012, Brussels

Alkali Booster	2,32
Sour (pH-Correction)	2,50

Unfortunately, the data delivered by Ecolab contains limited documentation about scope, methodology, etc. It is recommended that Ecolab – and other relevant suppliers –are asked to provide documentation according to the GHG Product Standard for future studies.

3.5 Impact of water and wastewater treatment

In order to assess the importance of water supply and wastewater treatment a simple assessment is performed using a rough estimate of the electricity consumption needed.

The assessment is based on the electricity consumed to treat one m³ of household wastewater in a typical municipal wastewater treatment plant. The number often cited is 1,0 kWh/m³. In order to consider the supply as well the value, 1,1 kWh/m³ is applied.

Naturally, a more detailed assessment might be performed considering also the content of organic matter in the wastewater. This might be considered when planning future studies.

4. Results and discussion

4.1 Results for the two services assessed

The estimated average GHG emissions for scopes 1, 2 and 3, are presented in table 10 for the two services assessed.

Table 10: Total estimated GHG emissions from the two services assessed

	Workwear	Hotel linen
Scope 1	<i>kg CO₂ eqv per service unit</i>	
Fuels for heating	16,1	41,8
Fuel for distribution	4,9	7,5
Scope 2		
Electricity	5,1	12,1
Scope 3		
Detergents	4,1	6,4
Textiles	15,1	21,3
Water/wastewater supply	0,3	0,6
Total	46 kg	90 kg

The differences in estimated emissions from the two services can be explained by the underlying assumptions stated in section 3.1:

- The average amounts of textiles for laundering (and distribution) are 51 kg for workwear and 157 kg for the hotel. These volumes relate to the emissions from scope 1 and 2 plus the consumption of detergents and water in scope 3.
- The average amounts of new textiles purchased are 1,1 kg for the workwear and 1,5 kg for the hotel option. These volumes relate to the supply of textiles in scope 3.

Actually, the impact of the supply of new workwear textiles is 22 times greater than the impact of laundering these textiles once. For the hotel linen option, the supply of new textiles has 33 times the impact of laundering these same textiles once.

Despite the limitations of this study, it is judged that the above figures provide a reasonably robust estimate of the impacts of the services. This is in particular because all input numbers are averages for a significant number of companies/plants.

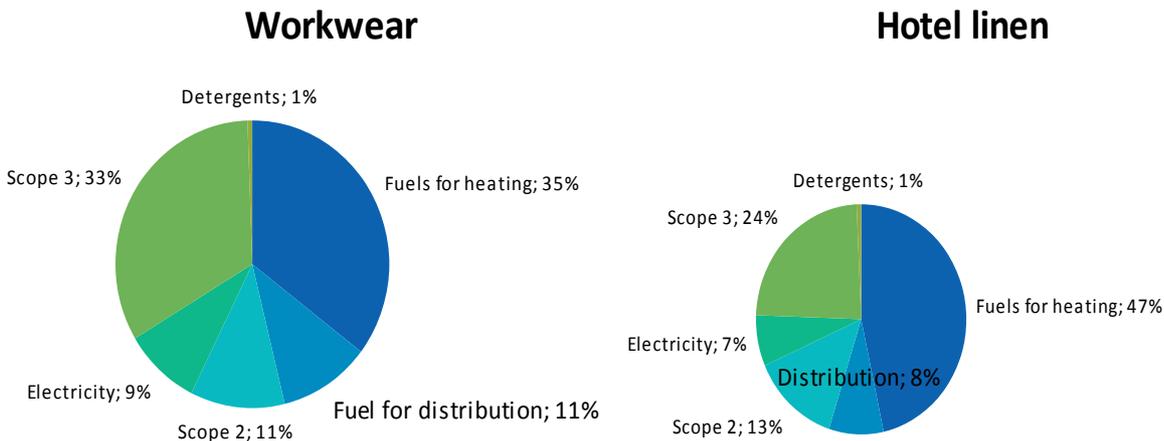
The shares of the different sources of impacts are illustrated below in figure 4. The differences can be explained by a number of reasons:

- Life-time of hotel linen – the number of times each item is washed before it must be discarded - is longer than for workwear. Hence, the supply of new textiles is relatively smaller for hotel linen
- Hotel linen requires less detergent than workwear

- Mechanical handling of the hotel linen in the laundries is higher than for workwear due to the need for ironing and folding.

All in all, the differences illustrated in figure 4 seem well in line with the expectations.

Figure 4: Percentage distribution of the GHG emissions for the two services.



The IMPRO Textile LCA study carried by the Joint Research Centre assessed the CO₂ impacts from the full range of textile products and fibre blends consumer by the EU market⁸.

According to this report, the distribution of GHG emission between textile production, transport and use is 52%, 5% and 45% respectively.

Compared to the study reported here, the IMPRO LCA study illustrates how the extended lifetime of the textiles maintained by textile service companies reduces the relative impact of textile manufacturing.

4.2 Sensitivity analysis

In order to assess the importance of the selected parameters on the estimates presented above, recalculations have been done with modified input figures or assumptions.

The impact of different WECO consumption has been assessed by application of the 10% and 90% percentiles from the WECO survey. Keeping all other parameters constant, the total CO₂ footprint for workwear is in a range of 36 - 66 kg CO₂ eqv per service unit. For hotel linen, the range is 86-164 kg.

This shows that WECO consumptions naturally have a significant impact on the total emissions but the variations stay within a reasonable range. Furthermore, this shows that the average carbon footprint

⁸ Beton.A, Dias.D, Farrant.L, Gibon.T, Le Guern.Y, Desaxce.M, Perwuelz.A, Boufateh.I, editors Wolf.O, Kougoulis.J, Cordella.M, Dodd.N, 2013, Environmental Improvement Potential of textiles (IMPRO Textiles), Joint Research Centre (IPTS), European Commission

calculated for the two service units lies relatively close to the 10% percentile. In other words, the average results are in the lower end of the range.

Another important factor to consider is the impact of the supply of new textiles. If the quantity of textiles supplied for the workwear option doubles, the total emissions would rise from 46 kg to 61 kg CO₂ eqv per service unit. If the supply of textiles is halved, the total is reduced to 38 kg. Doubling the supply of textiles for the hotel linen option increases the total from 90 kg to 111 kg, while halving the supply would give a total of 79 kg.

This shows the robust nature of the methodology and impact figures and assumptions used here.

4.3 Potential use of the results

As mentioned in section 2.2 above, the main incentives for ETSA and its member companies in preparing these product assessments were related to 'product differentiation', in particular to:

- Strengthen the textile services image regarding GHG performance
- Strengthen the reputation and accountability of textile services through public disclosure

In order to achieve these goals it is recommended to:

- Include climate change considerations in the relevant communications tools developed by ETSA, in particular, the ETSA website
- Prepare factsheets providing the key results that can be used for communication between member firms and their clients and other relevant stakeholders.

Furthermore, it is recommended to develop the CO₂ calculator tool in a way that it may be used to prepare company or laundry specific estimates for use in strengthening the reputation and accountability of the individual member companies.

5. Recommendations for future actions

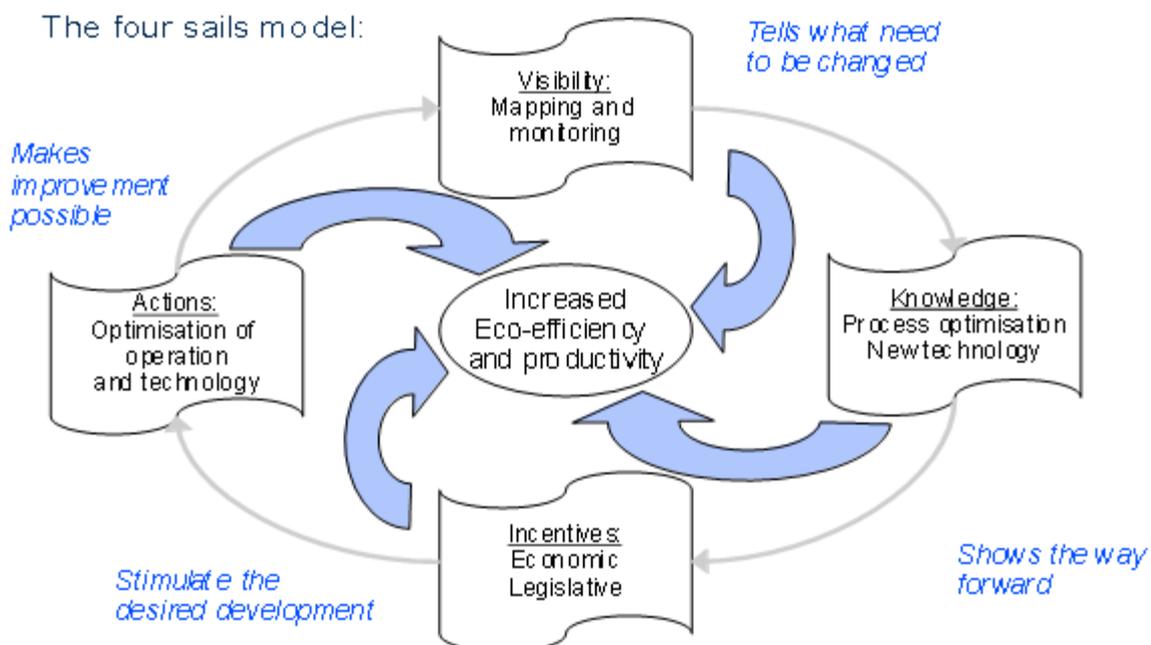
5.1 Methodology for calculation of GHG emissions

Regarding recommendations related to the methodology for calculation of GHG emissions, the following issues should be considered:

- Ensure registration of all relevant issues – in particular to establish an overview of the fate of the textiles when disposed of, and other solid waste fractions generated in the member laundries.
- Request an environmental declaration, including emission factors, from suppliers of fuel and electricity and integrate those factors into the developed CO₂ calculator spreadsheet.
- Establish a project regarding methodology for calculation of the GHG emissions from water supply and wastewater treatment, in order to assess these impacts in more details.
- Establish projects in cooperation with the relevant suppliers to identify the GHG impacts of the detergents used and the textiles purchased, including in both cases the impacts of the disposal, ensuring that the impacts are calculated according to the GHG Product Standard.

5.2 Reduction options for the GHG emissions / energy consumption

Regarding the actual reduction options for the GHG emissions, it is recommended to encourage member companies to establish resource saving campaigns based on the ‘four sails model’ – see figure below:



This model was developed in the Netherlands around 2000 and shows that it is important to include all four elements in the design of a campaign:

- **Mapping/monitoring** the actual situation provides visibility when the information is shared and shows what needs to be changed. *The completed ETSA WECO surveys can be seen as such an initiative.*
- **Knowledge** of process optimization opportunities and available new/best technology show the way forward if made available to the relevant parts of the organisation. *The established ETSA WECO catalogue of saving options was such an initiative, but this tool requires constant updating in order to be valuable as a knowledge source of optimisation opportunities.*
- **Incentives** are 'the power to the change-engine'. The incentives stimulate/motivate the desired development. They may be economic benefits achieved by better recognition in the market, direct savings of the resources, legislative demands/expectations or general environmental reputation. Each member company should perform the assessment of the relevant incentives and as such ETSA has no significant role to play in this element. *What ETSA could do is to prepare an assessment tool to support the members in identifying the potential savings and other benefits of the savings in resource consumption or other ways of reducing the emissions.*
- **Actions** naturally are the key to achieving a reduction in emissions, but the identification of the relevant actions is the result of the three other elements. Without mapping and monitoring, the organisations do not know where to take action; without knowledge the organisations do not know what actions to take, and without incentives the relevant actions might never be realised.

HG, EcoForum, April 2015

ANNEX 1: Survey of volume of laundering and volume of new textiles to provide the two services

During December 2013 ETSA member companies provided the data required to determine the average supplies to provide the two defined services in a separate survey.

The survey covered six ETSA member companies with respect to workwear and five member companies with respect to hotel linen supply. Together these member companies supply textile services to most of Europe. The average numbers from the survey are shown below in tables 2.1 to 2.4. The individual contributions from the member companies are considered confidential and will not be released to the public.

Product specialists from the individual member company headquarters provided these data based on internal sources of supply statistics.

The specialists were required to deliver data for their average composition of a supply, including:

- Which items are included?
- What are the average weights per piece for the relevant items?
- What are the material compositions for the items (share of cotton versus polyester)?
- How many pieces are purchased to renew the stock - calculated as average for the actual service?
- How many times per year are these items washed to provide the service – on average?

Based on these data two key numbers were calculated – see table 2.2 and 2.4:

- The average weight of textiles to be laundered to provide the service, and
- The average weight of new textiles purchased to provide the service

Table 2.1: 2013 survey data regarding workwear service (supplying one worker for one year)

	Average weight (g/piece)	Average percent cotton %	Average percent polyester %	Average weight (g/m ²)	Average number of washes per year
Trousers/overalls	612	34	66	257	34
Jackets	589	34	66	261	26
T-shirts	271	54	46	202	40
Other items*	550	65	35	280	46

*One of the six companies supplies 'other items' as part of the service.

Table 2.2: Average supplies for workwear service (supplying one worker for one year)

	Volume of laundering (kg/year)	Number of new textile items required*	Weight of new textiles - cotton (kg/year)	weight of new textiles - polyester (kg/year)	Weight of new textiles – total (kg/year)
Trousers/overalls	20,5	0,69	0,144	0,277	0,421
Jackets	15,1	0,51	0,103	0,198	0,300
T-shirts	10,9	0,99	0,146	0,123	0,269
Other items:	4,2	0,2	0,1	0,0	0,1
Total	50,7	2,41	0,47	0,64	1,11

Table 2.3: 2013 survey data regarding hotel room service (supplying one hotel bed for one year)

	Average weight (g/piece)	Average percent cotton %	Average percent polyester %	Average weight (g/m ²)	Average number of washes per year
Sheets	643	75	26	153	59
Duvet covers	1055	68	32	150	57
Pillow covers	184	69	31	150	60
Towels	494	96	4	466	76
Other items*	575	90	10	535	45

*Two of the five companies supply 'other items' as part of the service.

Table 2.4: Average supplies for hotel room service (supplying one hotel bed for one year)

	Volume of laundering (kg/year)	Number of new textile items required*	Weight of new textiles - cotton (kg/year)	weight of new textiles - polyester (kg/year)	Weight of new textiles - totally (kg/year)
Sheets	37,9	0,57	0,272	0,093	0,366
Duvet covers	60,1	0,56	0,399	0,188	0,586
Pillow covers	11,1	0,47	0,060	0,027	0,087
Towels	37,6	0,54	0,259	0,011	0,269
Other items:	10,4	0,26	0,13	0,01	0,15
Total	157	2,40	1,12	0,33	1,46

ANNEX 2: Glossary

Carbon dioxide equivalent (CO₂ eqv.): The universal unit of measurement used to indicate the global warming potential (GWP) of each of the six Kyoto greenhouse gases. It is used to evaluate the impacts of releasing (or avoiding the release of) different greenhouse gases.

Climate change: A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability over comparable time periods (Source: United Nations Framework Convention on Climate Change).

Direct emissions: Emissions that are produced by organisation-owned equipment or emissions from organisation-owned premises, such as carbon dioxide from electricity generators, gas boilers and vehicles, or methane from landfill sites.

Global warming: The continuous gradual rise of the earth's surface temperature thought to be caused by the greenhouse effect and responsible for changes in global climate patterns (see also Climate Change).

Global warming potential (GWP): The GWP is an index that compares the relative potential (to CO₂) of the six greenhouse gases to contribute to global warming i.e. the additional heat/energy which is retained in the earth's ecosystem through the release of this gas into the atmosphere, The additional heat/energy impact of all other greenhouse gases are compared with the impacts of carbon dioxide (CO₂) and referred to in terms of a CO₂ equivalent (CO₂ eqv.) e.g. carbon dioxide has been designated a GWP of 1, methane has a GWP of 21.

Greenhouse gases: The current IPCC inventory includes six major greenhouse gases. These are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆).

IPCC: The Intergovernmental Panel on Climate Change. A special intergovernmental body established by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) to provide assessments of the results of climate change research to policy makers. The Greenhouse Gas Inventory Guidelines are being developed under the auspices of the IPCC and will be recommended for use by parties to the Framework Convention on Climate Change.

Indirect emissions: Emissions that are a consequence of the activities of the reporting company but occur from sources owned or controlled- by another organisation or individual. They include all outsourced power generation (e.g. electricity, hot water), outsourced services (e.g. waste disposal, business travel, transport of company-owned goods) and outsourced manufacturing processes. Indirect emissions also cover the activities of franchised companies and the emissions associated with downstream and/or upstream manufacture, transport and disposal of products used by the organisation, referred to as product life-cycle emissions.

Kyoto Protocol: The Kyoto Protocol originated at the 3rd Conference of the Parties (COP) to the United Nations Convention on Climate Change held in Kyoto, Japan in December 1997. It specifies the level of emission reductions, deadlines and methodologies that signatory countries (i.e. countries who have signed the Kyoto Protocol) are to achieve.