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Deliverable D 2.2: Inventory results
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2nd Revision - March, 2015

ICPI

0. Introduction

IND-ECO Project has the following main objectives for **Work Package 2** ***Inventory and benchmarking:***

- To check energy consumption in the tanning and footwear sectors;
- To identify efficiency areas and technical improvement opportunities;
- To build companies capacity to plan and support the energy efficiency process.

This work-package consists in activities aiming at:

✓ raising companies' awareness of energy consumptions and environmental impacts;
✓ focusing on energy consumption of the involved sectors (tanning, and footwear);
✓ allowing involved companies to know their consumptions and CO2 emissions and their position relative to the benchmark;
✓ defining a starting position to evaluate investment opportunities and to assess the achieved results.

These activities will be developed under the following WP2' tasks:
2.1. Task organization
2.2. Sector-specific inventories
2.3. Benchmark definition
2.4. Energy audit and benchmarking [1]
In order to realise the sector - specific inventories, firstly were defined the questionnaires, these were translated in 6 languages and for both sectors, footwear and tannery, were made available to fill-in online on the platform developed by CTCP.
Due to the delays and difficulties encountered in data & questionnaires collection (these problems were identified and presented in D2.1), during the 12 Months Meeting in Porto, Portugal, the consortium has taken the following corrective actions regarding WP2 [2]:

DECISION 2.1
Revise the timing of the different task, as follows:

- Task 2.2 Inventories: new end month 16
- Task 2.3 Benchmarks: new end month 16
- Task 2.4: Audits: new month 24

DECISION 2.2, the number of questionnaires to be collected was revised due to the structure of the sectors in the different countries and to the current difficulties encountered in data collection. Final objectives per country are in the following table:

	UK	ES	IT	BU	PT	RO	TOTAL
FOOTWEAR	6	35	20	36	70	40	207
TANNING	13	10	70	4	3	6	106
TOTAL	**19**	**45**	**90**	**40**	**73**	**46**	**313**

COTANCE ACTION: Collection of about 20 questionnaires from other countries not participating in the project (like Germany, France etc.).

1. Sector-specific inventories

The questionnaires were uploaded directly by companies or by the project partners who discussed and contacted them by phone or e-mail in order to collect data.
For each country technical centres or associations verified and anonymised the online uploaded inventory data.

Questionnaires collection: have been collected and uploaded on CTCP platform a total number of 276 questionnaires, representing about 83% from the revised number proposed in Porto Meeting (Decision 2.2). The intermediary data were presented to the project partners during the 12 Months Meeting in Porto, Portugal and 18 Months Meeting in Milan, Italy.
According to the **Decision 2.3 from 30 Month Meeting – Sofia**, the audits will continued till the end of February 2015 and also more questionnaires were collected (during audit activity) in order to review the benchmarks for tanneries (new term 15.03.2015). Along these lines at the Final Meeting in Brussels (18 March 2015) it was conclusively reported that: **286 questionnaires were collected** (85 for tanneries and 201 for footwear companies), as presented in Table 1 and Figure 1. This has been evidently a sufficient start population for Inventory Analysis tasks carried out in WP 2.3 and eventually company benchmarking. Concomitantly, this deviation has not affected dataset quality and representativeness of the EU-benchmarks, as demonstrated by the Statistical Analytical results presented in detail with D 2.3.

Table 1. **QUESTIONNAIRES COLLECTION**

COUNTRY	No. of inventories FOOTWEAR		No. of inventories TANNERIES		TOTAL	
	Proposed	***Realised***	***Proposed***	***Realised***	***Proposed***	***Realised***
ITALY	20	11	70	52	**90**	**63**
PORTUGAL	70	76	3	-	**73**	**76**
ROMANIA	40	40	6	5	**46**	**45**
BULGARIA	36	36	4	1	**40**	**37**
SPAIN	35	36	10	15	**45**	**51**
UNITED KINGDOM	6	2	13	11	**19**	**13**
COTANCE	-	-	20	1	**20**	**1**
TOTAL	**207**	**201**	**126**	**85**	**333**	**286**

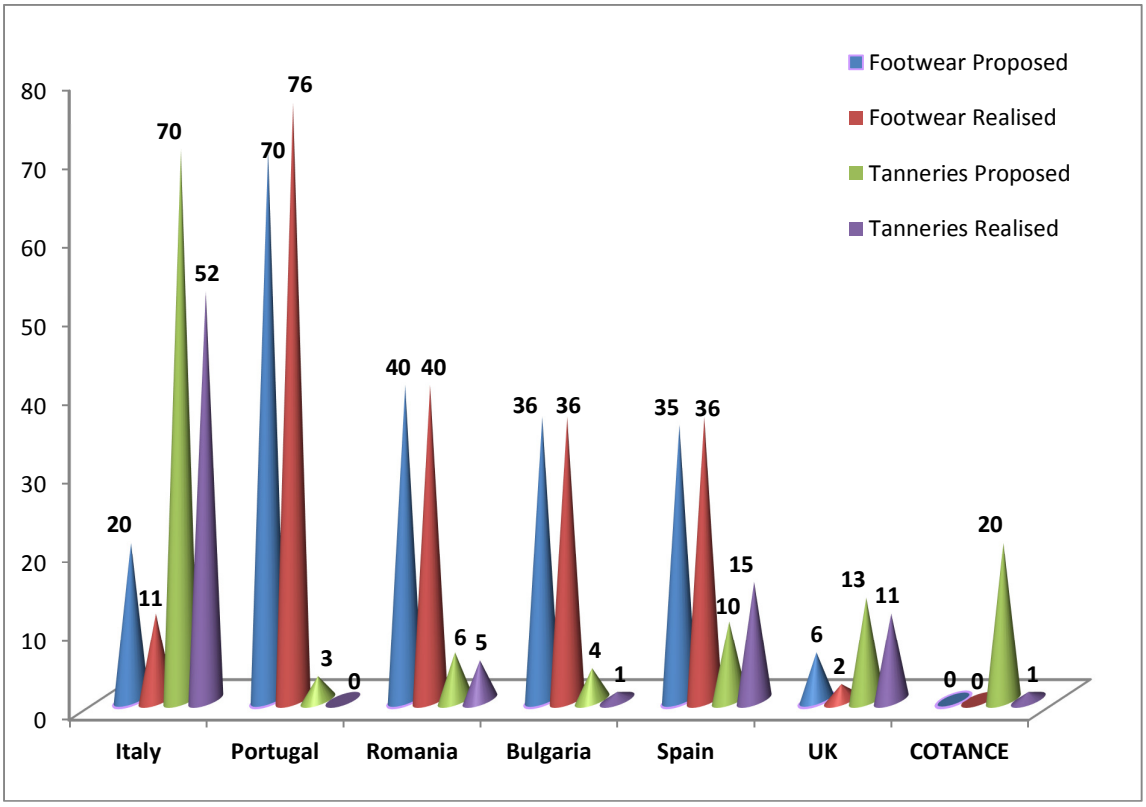


Figure 1. Questionnaires collection

2. Benchmark definition preparation

In order to establish the basic elements and calculation methodologies for benchmark definition in both sectors, a literature collection study was performed and presented to the partners. Significant literature data and their source (indicated in brackets into the text and in details in "Bibliography" chapter) were obtained mainly from European countries - Italy, France, Switzerland – and worldwide – UNIDO studies - for tanneries and from Germany, Romania, USA and Asia for footwear sector.

The following definition and data were acquired for the tanning and footwear sectors.

TANNING SECTOR - Literature collection data

2.1. Sustainable development

Sustainable development has become a target also in leather processing.

This, among others, is commensurable through energy and water consumption and is known as LITE (Low impact to environmental leather) being confirmed by a label which is a certificate that can be attached to the product.

The certification specifies the CO_2 emission and water litres used for 1 sqm leather produced.
The LITE standard is based on the BLC elaborated calculation for the average consumption of water and energy and is closely related to managerial and technical performance.

2. 2. BEET (Best Energy Efficiency for Tanning)

BEET establishes the best consumption level for the entire production process, in a location and defined boundaries, based on guidelines data given by BAT-EU-Best Available Techniques for the Tanning of Hides and Skins with the help of BEET, the factory can compare its own energetic consumption with a reference energy efficiency reached.

2.3. CCF (Corporate Carbon Footprint)

CCF represents the CO_2 equivalent emission during the production process and complementary activities which complete to achievement and leather sale based on a proposed calculation model.

2.4. Evaluation of energy consumption

The energy consumption evaluation is done for various production volumes, kind of leather article, location, for constituent elements of manufacture, as follows:
-technological activities
-component activities upstream of process (skins, hides and chemical supply)
-component activities downstream of process (sale and wastes)

2.5. Benchmark & Benchmarking

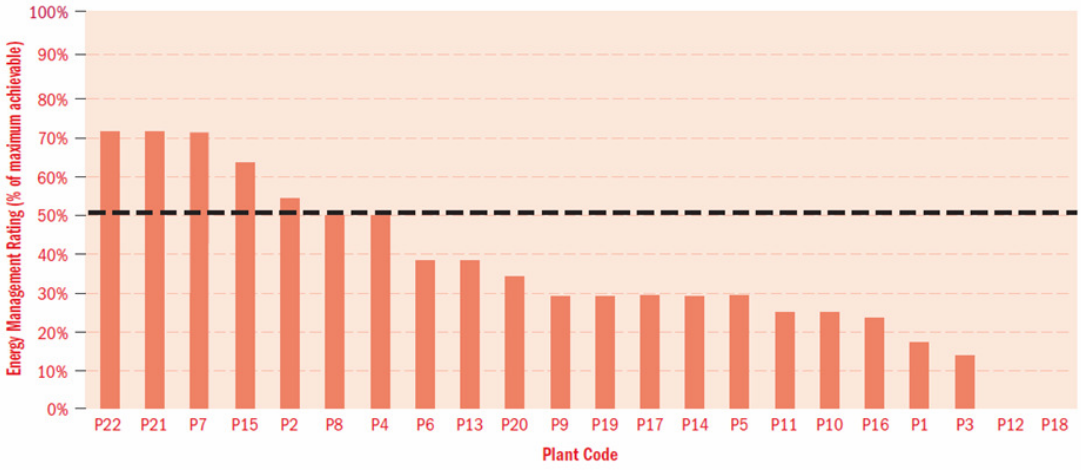
Based on a literature review some definition of benchmark / benchmarking definitions could be:

Benchmark Reference numerical value, top, of an activity in relation to which you can observe, judge, measure another similar activity as an object and subject to study. It is the stationary point of the observer, in terms of value and position, throughout the study period.

Benchmarking
Concept of rules and continuous learning, based on criteria, key indicators and set of actions which orient you to the best practice compared to reference numerical value, accepting changes that are necessary.

According to the “Energy performance benchmarking on best practices in Canadian textiles wet processing” document, the benchmarks in are “intended to be used as baselines against which plants can compare their relative performances. To serve as realistic performance targets, their values are set at the 75th percentile in each of the three dimensions: energy use and intensity, technical best practices and energy management practices. A benchmark at the 75th percentile is a calculated value,

where 75 percent of participating plants underperformed and 25 percent of plants outperformed the benchmark". In this context a technical "Best practice" is defined as a production system or efficiency measure that results in an overall reduction in energy intensity. [3]



Benchmarking "implies the comparison of the energy efficiency and CO_2 emissions of individual installations *based on a point reference, often "best available technology" (BAT).* However, data for individual facilities are often confidential because of anti–trust regulations or other concerns. Moreover, data collection is resource and time consuming". [4]

Benchmarking **-** **"**It is the comparative evaluation between the organisation and the relevant sector previous and current energy performance". [5]

Benchmarking "is a vital tool in assessing the performance of an installation, process or system, by verifying against external or internal energy usage levels or energy efficient methods

Benchmark at its simplest, is a reference point. In business, ***benchmarking*** is the process used by an organisation to evaluate various aspects of their processes in relation to best practice, usually within their own sector. The process has been described as:

• 'benchmarking is about making comparisons with other companies and then learning the lessons which those companies each show up' (The European Benchmarking Code of Conduct)

• 'benchmarking is the practice of being humble enough to admit that someone else is better at something, and being wise enough to learn how to be as good as them and even better' (American Productivity and Quality Center).

Data confidentiality may be important in certain cases (e.g. where energy is a significant part of the cost of production). Therefore, it is essential to take into account the views of the participating companies and sector associations to safeguard the confidentiality of company data and to ensure the user-friendliness of the instruments. Confidentiality can be protected by:

• agreement
• presenting data in a way that protects the confidential data (e.g. presenting data and targets aggregated for several installations or products)
• having data collated by a trusted third party (e.g. trade organisation, government agency).” [6]

In the frame of IND ECO Project a need for clarification raised on the system boundaries to be adopted for the calculation of energy consumptions. It has been clarified that in both sectors, energy consumptions have to be evaluated within the factory borders (the so called “gate to gate” approach. No energetic consumptions outside the factory shall be considered. Process phases subcontracted to third parties will be taken into consideration in benchmark definition but not in the definition of improvement areas for single companies. [2]

Best practice is “The application of the most appropriate and cost-effective energy efficiency technologies and management techniques and refers to the techniques and technologies at the upper end of the performance range identified in a benchmark comparison.” [7]

Benchmarking classification
Seen through the objectives, an example of benchmarking classification is presented in table below:

Objective	Content	Required level resources
Strategic *Determine opportunities for change strategy in the organisation processes*	*Analysis of the global leading companies in non-competing industries*	*Average - low* *Trained experts in benchmarking techniques*
Performance	*Analysis of relative business performance between direct or indirect competitors based on official published data*	*Low* *Own strengths or consulting companies*
Process	*Performance analysis in key processes at leading companies*	*High* *Own strengths*

2.6. Basic characteristics of a modern tannery

According to UNIDO expert consultant Iakov Buljan [8], the basic characteristics of a modern tannery are as follows:

Location	•The tannery should be outside residential areas, preferably within an industrial zone, proximity of urban sanitary sewage network and wastewater works or at the seaside •Sufficient supply of water of appropriate quality, stable and reliable power grid •Solid waste utilisation and disposal facilities •Easy access for employees and cargo (public transport, roads, railway, airport, harbour) •Reliable and efficient transport, forwarding and customs clearance services •Proximity of finished leather markets
Production parameters	•Raw material: Fresh (chilled) hides from abattoir, machine-flayed •Weight category: 25-30 kg/hide, area about 4 m^2 (cca 43 sq ft)/, thickness 6-8 mm •Input/soaking: About 300-350 pieces, ie 7,5-10 tonnes of raw hides/day •Output/production: About 1,300 m^2 (about 14,000 sq ft)/day of grain leather + about 590 m^2 (about 6,300 sq ft) of split leather, total: 1,890 m^2 (20,300 sq ft)/day
Technology	Hair-save liming, carbon dioxide deliming, ex-lime splitting, high exhaustion chrome tanning with full chrome management system, vegetable and environment friendly syntan retanning, optimum exhaustion of dyes and fatliquors, segregation of beamhouse, all chrome bearing and general streams, use of biodegradable surfactants and acceptable biocides, optimised mechanical dewatering and drying, (predominantly) water based finishing. Total amount of chemicals consumed about 4,5 tonne/day. Work cycle not exceeding three weeks.
Equipment	•High accuracy splitting and shaving, drums suitable for short floats, recycling, good distribution of chemicals, optimized coating, scrubbers for air emissions. •High level of automation and process control - automated water, chemicals dosing and mixing systems but also staking and transport.
Yield	1,300 m^2/10 tonnes = 13.0 dm^2 (1.4 sq ft) of grain leather/kg green weight + 590/10 tonnes = 5.9 dm^2 (0,63 sq ft) of splits/kg green weight. Total 1,890 m^2 (20,300 sq ft)/ 10 tonnes = 18.9 dm^2 (2 sq ft) of leather/kg of green weight. Tailor made software monitoring.
Rework, claims	Internal up to 5%, external below 2%. Tailor made software monitoring.
Workforce	85-90 (75 production), without ETP
Productivity	1,890 m^2 (20,300 sq ft)/75 = 25 m^2 (270 sq ft)/day/production; Tailor made software monitoring
Power installed	Approximately 700-750 kW, production & auxiliary equipment but without ETP
Water consumption	Not exceeding 25 m^3/tonne raw hide, total around 250 m^3/day, including sanitary water. Strict water housekeeping, water meters for each department

Factory compound	The ratio of built vs total factor/ area - footprint less than 0,6.
Works area	All at ground level (except workshop mezzanines & .supervisor & control panel booths), around 3,000 m^2
Stores & workshops, offices, sanitary areas	Raw hides, chemicals, hazardous chemicals, maintenance & spare parts, wardrobes, toilettes etc. 1,500 m^2
Total	4.500 m^2 of covered area + 600 m^2 for the physical-chemical effluent treatment, the total compound ideally about 10,000 m^2 (1 ha). If the biological treatment is also required, an additional 1,000 m^2, ie total 11,000 m^2 needed.
Occupational safety and health	All OSH measures strictly and consistently applied with emphasis on personal protection and measures against toxic (hydrogen sulphide) and inflammable materials (solvents) risks.
Human resources, CSR	Sanitary facilities in conformity with highest standards. Quality and output linked, competitive remuneration, incentives for innovations. Systematic and continuous training, exposure to global trends and developments. Staff welfare facilities (canteen, creche, ambulance, recreational area) available within the factory compound or at short distance. Continuous, open dialogue with public.
Financial performance	Favourable ratio of administrative and (individual articles differentiated) production costs Low stocks/ working capital: up to one month for raw hides, about three weeks for hides In work, up to two weeks for specialty chemicals, less than a week for finished leather). Optimum pricing. The return on sales/assets meets/exceeds the cost of own and borrowed capital and anticipated dividends.
Product development and strategies	A system for continuous monitoring of the relevant (global) research, access to and dissemination of information in place. Close cooperation of marketing and technology. Alternatives - fall back strategies for various negative scenarios.
Solid wastes	Total of about 5 tonnes / day (at different levels of water content), albeit without tannery sludge. Strict segregation, HACCP procedure followed. Native trimmings, hair, fleshings, shavings and unusable splits reutilised, only finished trimmings disposed of.
Effluent treatment plant, ETP	Discharge into the municipality sewage or the common treatment plant for the industrial zone/cluster; thus only the primary (physical-chemical) treatment carried out by the tannery itself, whereas the secondary (biological) treatment carried out together with sanitary waters at the municipality wastewater works. In any case, treatment efficiency in line with IULTCS/IUE figures, the reduced pollution load conforms to legislative norms.

Treatment capacity, effluent quality	250 m^3/day corresponding to a water consumption of 25 m^3/tonne, working on tannery work-days, 20 hours/day. Highest treatment efficiency, the effluent quality conforms to norms for indirect discharge
Area required	About 600 m^2 (physical-chemical treatment only)
Power	Power installed about 75 kW; energy consumption about 45 kWh/h (about 60% of power installed)
Chemicals needed	Catalyst (manganese sulphate) inorganic coagulant (alum sulphate or polychloride, polyelectrolyte for flocculation, hydrated lime for pH correction and/or sludge conditioning.
Sludge handling	Primary sludge dewatered to about 40% dry matter content (nearly 2,5 tonnes/day) forwarded to controlled landfill, land application - composting or thermal treatment.
Treatment costs	Up to US$ l/m^3. After adding the cost of joint treatment at the wastewater plant, the total treatment cost is likely to be in the region of US$ 1.5-1.6/m^3.
In the highly undesirable case of direct discharge into a water recipient (river, lake), ie when a tannery has to have the secondary (biological) treatment, the total area required for the ETP is about 70 x 25 ~ 1,750 m^2, power installed 120 kW and power consumption about 70 kWh/h *Total investment costs for such a plant in a developing country would be of the order of US$ 230,000 (civil works), equipment US$ 470000, and a total of around US$ 700,000. The costs of land, ETP design, supervision and commissioning as well as any taxes are not included in this figure.* *As pointed out earlier, an individual fully-fledged tannery ETP following the conventional technology can successfully reduce all pollutants (suspended solids, BOD, COD, nitrogen, sulphide etc.), to the acceptable level; however, without reverse osmosis - desalination (or, better, mixing with municipal effluents) it has no effect on Total Dissolved Solids (IDS), colloquially - salinity.*	

2.7. Energy consumption. Benchmark

2.7.1. Energy consumption in Tannery sector

Electric energy consumption
Shoe uppers leathers
Electricity consumption. Average per product unit *– Italy data* [9]

Process type Operation	Thickness thick leathers, upper		Thickness thin leathers, upper		Thickness thin velour leathers	
	kWh	%	kWh	%	kWh	%
Soaking-liming	0,014	0,40	0,014	0,76	0,014	0,70
Fleshing	0,094	2,70	0,045	2,45	0,045	2,21
Splitting	0,035 wet blue	1,01	0,033 pelt	1,81	0,033 pelt	1,63
Tanning preparation	0,030	0,86	0,030	1,63	0,030	1,48
Tanning	0,104	2,98	0,104	5,66	0,104	5,12
Shaving	0,236	6,76	0,122	6,65	0,122	6,01
Wet end	0,029	0,83	0,028	1,57	0,028	1,42
Samming stretching	0,133	3,81	0,049	2,68	0,049	2,43
Stretching	0,084	2,40	0,064	3,50	-	-
Drying	0,507	14,51	0,132	7,17	0,082	4,06
Stacking	0,112	3,20	0,055	3,03	0,055	2,74
Stretching	-	-	0,059	3,21	0,060	2,95
Dressing	0,172	4,92	0,129	7,00	-	-
Embossing	0,011	0,34	0,023	1,28	-	-
Buffing	0,400	11,44	-	-	0,533	26,16
Dedusting	0,216	6,18	-	-	0,288	14,14
Embossing	0,481	13,77	0,361	19,59	-	-
Measurement	0,008	0,25	0,008	0,47	0,008	0,42
Waste water treatment	0,612	17,49	0,366	19,88	0,366	17,98
Lighting	0,215	6,15	0,215	11,66	0,215	10,55
Total	**3,493 kWh/m^2**	**100,00**	**1,837 kWh/m^2**	**100,00**	**2,032 kWh/m^2**	**100,00**

Thickness thick leathers, upper: 1,7 mm
Thickness thin leathers, upper: 1,0 mm
Thickness thin velour leathers: 1,0 mm

Electric energy consumption
Shoe uppers leathers

For 1 sqm uppers, on the operation of the entire process, ***electricity consumption*** *is presented in the following table – Italian data* [10]*:*

Nr.crt	Operation	Absorbed energy, kWh	Share, %
1	*Soaking-liming*	0,0344	0,8
2	*Fleshing*	0,1205	2,8
3	*Deliming-Bating-Pickling-Tanning*	0,5917	9,1
4	*Samming*	0,0731	1,7
5	*Splitting*	0,0344	0,8
6	*Shaving*	0,1162	2,7
7	*Wet-end*	0,0990	2,3
8	*Samming*	0,1205	2,8
9	*Pasting drying*	0,2455	5,7
10	*Vacuum drying*	0,2281	5,3
11	*Stacking*	0,0516	1,2
12	*Finishing*	0,3185	7,4
13	*Buffing-dedusting*	0,3530	0,2
14	*Embossing*	0,3616	8,4
15	*Measurement*	0,0086	0,2
16	*Waste water treatment*	0,9127	21,4
17	*Lighting*	0,2195	5,1
18	*Other uses*	0,6070	14,1
Total		**4,4959**	
For calf skin the consumption may decreases to 3,200 kWh			

Observation:
The amount of absorbed energy was calculated by multiplying of % share with total value determined for 1 sqm of leather

Annually production: 232.250 m^2
Annually consumption: 1.000.000 kWh

$$\textbf{Electric consumption Kwh on 1 sqm} = \frac{\textbf{1.000.0000}}{\textbf{232.250}} = \textbf{4,3057 kWh}$$

Electric energy consumption
Shoe uppers leathers

Distribution of power in workshops *according to a study made by UNIDO in 600 tanneries from Argentina* [11]

Operation	%
Soaking-liming	16
Tanning	16
Wet-end	26
Mechanical operations and drying	21
Surface finishing	21

Electricity consumption kWh/sqm [11]

Skins (surface < 0,6 sqm)	**3-4**
Leather > 0,6 sqm	**1,8-2,0**

Electric and thermal energy consumption
Shoe uppers leathers

Nr. crt.	Article	Uppers		Uppers		Velour		Velour from wet blue	
	Thickness, mm	**1,7**		**1,0**		**1,0**		**0,7**	
	Consumption for	**Electricity kWh/m^2**	**Heat kWh/m^2**	**Electricity kWh/m^2**	**Heat kWh/m^2**	**Electricity kWh/m^2**	**Heat kWh/m^2**	**Electricity kWh/m2**	**Heat kWh/m^2**
1	*Hot water*	-	5,10	-	3,06	-	3,06	-	2,04
2	*Drying*	0,51	4,22	0,19	1,48	0,14	1,88	0,095	1,26
3	*Finishing*	0,17	1,75	0,13	1,31	-	-	-	-
4	*Mechanical operations*	2,82	-	1,52	-	1,90	-	1,593	-
5	***Total***	***3,50***	***11,07***	***1,84***	***5,85***	***2,04***	***4,94***	***1,69***	***3,30***
6	**Grand total**	**14,57**		**7,69**		**6,98**		**4,99**	

Italy data [9]

External temperature, 0C	+8,2
Specific consumption, m^3/m^2	0,20
Fuel consumption, KWh/m^2	6,3
Electricity consumption, KWh/m^2	3,3
Total consumption, KWh/m^2	**9,6**

Switzerland data [12]

Electric and thermal energy consumption
Small and medium size skins French data [13]

Article type	TEP / 9.200 m^2	Consumption , kWh/m^2
Bovines	26,40 (322,344 x 10^3 kWh)	35,03
Skins	9,53 (116,361 x 10^3 kWh)	12,64
Clothes	7,22 (88,156 x 10^3 kWh)	9,58

1 TEP = 12,21 x 10^3kWh

Calf skins, bovines chrome tanned French data [14]

Annually production, m^2	Energy necessary TEP	Consumption, kWh/m^2
19.100.000	7.600 (927.960 x 10^3 kWh)	48,58

Electric and thermal energy consumption
Wet-blue Italian data [9]

Nr. crt.	Operation Energy type, kWh/kg	Hot water preparation	Drying	Finishing	Mechanical operations
1	*Electricity*	-	-	-	0,73
2	*Thermal energy*	3,38	-	-	-
3	***Total***	***3,38***	**-**	**-**	***0,73***
4	**Grand total**	**4,11**			

Electric and thermal energy consumption
Sole leathers Italian data [9]

Nr. crt.	Operation / Energy type; kWh/kg	Hot water preparation	Drying	Finishing	Mechanical operations
1	*Electricity*	-	0,087	-	0,243
2	*Thermal energy*	0,25	1,51	-	-
3	***Total***	***0,25***	***1,59***	**-**	***0,243***
4	**Grand total**	**2,08**			

Annually production, t	Necessary energy TEP	Consumption, kWh/kg
5.100	3.000 (36.630 x 10^3 kWh)	7,18

French data [14]

Shaved butt - Fresh wet salted, 14-16 kg/piece Annually production: 1.250 tons

Nr. crt.	Consumption	Total amount	Consumption, kWh/ kg
1	*Electric consumption*	800.000 kWh	0,64
2	*Thermal consumption*	220 TEP (2.686.200 kWh)	2,14
	Total		**2,78**

Italian data [10]

Electric and thermal energy consumption
Furs **–** French data ***[14]***

Annually production, pieces	Necessary energy TEP	Consumption kWh/m^2
45.106 (26,5 x 106m^2)	27.000 (329.670 x 103 KWh)	12,44

1 piece ≈ 0,59 sqm

Synthetic data - Italy **–** UNIC Report, 2012 [15]

INDICATOR	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Energy consumption per product unit (TOE/1.000m^2)	2,4	1,6	1,30	1,20	1,20	1,09	1,17	1,25	1,07	1,14	1,16
Electric power share of total consumption (%)	51,4	50,1	54,8	52,6	51,9	54,6	52,6	49,1	53,5	54,8	52,5
Methane share of total consumption (%)	45,1	44,5	38,8	43,3	42,7	41,5	42,7	46,8	44,0	44,1	43,3
Costs incurred to reduce energy consumption/turnover (%)	-	-	-	-	-	0,04	0,04	0,03	0,06	0,09	0,12

1TEP = 12,21 x 10^3 kWh
Energy consumption in 2012: 14,16 kWh/m^2

Currently available benchmark

CO_2 emission LWG (Leather Working Group) kg CO_2/sqm product

Quantity	Appreciation
0-6,58	good
8,04	average
9,65	fair
15	poor

ISA Tan Tec

-21,5 MJ/sqm (industry average 61 MJ) for the production of wet-blue to finished leather (Source: www.leathermag.com,14 September 2012)
-33 MJ/sqm of leather in comparison with a leather industry standard of approximately 52 MJ (calculation by BLC - Leather Technology Centre, UK) [16]

Prime Asia
-5,28 metric kilograms of CO_2 per sq foot leather, 1.2-1.4 mm [17]

FOOTWEAR SECTOR - Literature collection data

2.7.2. ENERGY CONSUMPTION – FOOTWEAR

Energy **- orientative values**

No.	Company	Value	UM	Source	Obs.
1	Nike- Air Pegasus 25, USA	42	kWh/ pair	Nike Corporate Responsibility Report www.nikebiz.com	LCA
2	Nike, USA	9.4-8.8	kWh/ pair	Nike Corporate Responsibility Report www.nikebiz.com	Production/ 2004-2006
3	ADIDAS football boots, Germany	0.81	kWh/ pair	Environmental Statement 2010 www.adidas-group.com/en/sustainability/assets/environmental_statements/Environmental_Statement_2010_english.pdf	Production/ 2010
4	ASICS-G-KAYANO 17, Japan	2.031	kWh/ pair	Manufacturing-focused emissions reductions in footwear production, 2013 www.sciencedirect.com/science/article/pii/S0959652612006300	Assembling operations
5	Romania (7 companies)	0.768 (0.31-1.73)	kWh/ pair	Research Project 36/1988	Leather uppers
6	Romania (5 companies)	0.542 (0.23-0.85)	kWh/ pair	Research Project 36/1988	Leather substitute uppers

[18]-[21]

CO2 – Orientative values

No.	Company	Value	UM	Source	Obs.
1	Timberland*, USA	9.97-99.7	kg	Six Products, Six Carbon Footprints online.wsj.com	LCA, all products types
2	Timberland*, USA	9.97-19.96	kg	Six Products, Six Carbon Footprints online.wsj.com	LCA, flip-flops
3	Timberland*, USA	29.7-59.4	kg	Six Products, Six Carbon Footprints online.wsj.com	LCA, shoes
4	Timberland*, USA	69.3-89.1	kg	Six Products, Six Carbon Footprints online.wsj.com	LCA, hitking boots
5	Nike- Air Pegasus 25, USA	18	kg	Nike Corporate Responsibility Report, www.nikebiz.com	LCA
6	TOMS, USA	5.89	kg	Total Carbon Footprint of TOMS Shoes www.jinhlee2.blogspot.ro/2011/10/total-carbon-footprint-of-toms-shoes.html	Production Chain of TOMS shoes
7	ASICS, Japan -Running shoe made from synthetic materials	14±2.7	kg	ASICS CSR Report 2013 www.asics.com/global/img/responsability/G12/csr2013_global.pdf www.sciencedirect.com/science/article/pii/S0959652612006300	Throughout its value chain (LCA)
8	ASICS, Japan -Running shoes	18-41	kg	Manufacturing-focused emissions reductions in footwear production, 2013 www.sciencedirect.com/science/article/pii/S0959652612006300	LCA

9	ASICS, Japan - Gel Kayano 17 running shoes	29-68	kg	Manufacturing-focused emissions reductions in footwear production, 2013 www.sciencedirect.com/science/article/pii/S0959652612006300	Materials processing+ manufacturing

[18]-[21]

Based on the LCA studies conducted on a cross-section of Timberland, USA product line, were determined that the Green Index® rating system boundaries must include

footwear manufacturing and raw-material production. They chose not to incorporate transportation (neither between material supplier and manufacturer nor between manufacturer and our distribution center), as these impacts are small (typically less than 5% of the overall climate impact based on life-cycle analysis) and overly complex to track with accuracy.

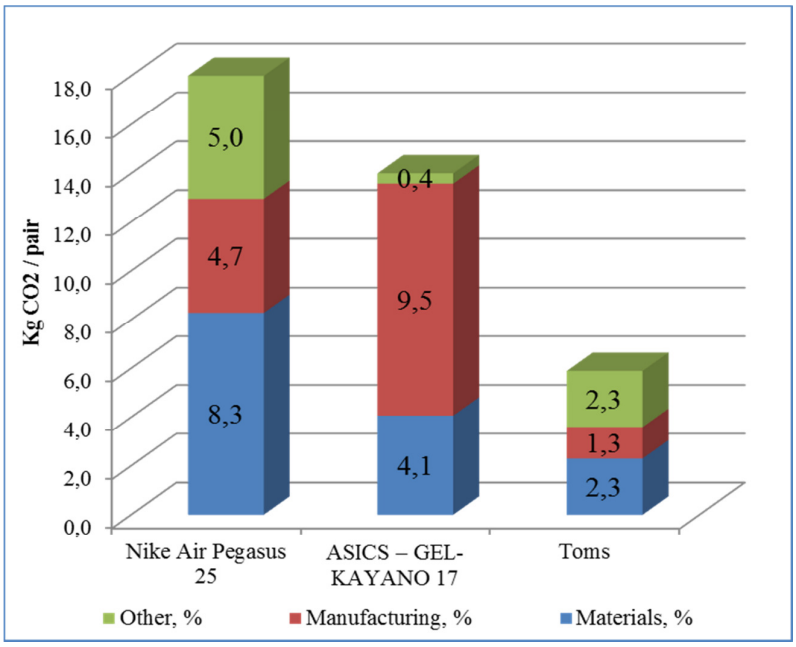
Timberland also have not included any impacts from the disposal of waste materials or from our products at end of life, as these impacts are relatively small compared to the pollution created by raw-material production and manufacturing. [22]

Thermal energy

No.	Company	Value	UM	Source	Obs.
1	Romania (7 companies)	5.48 (0.05-2.26)	Kgcc/ pair	Research Project 36/1988 1Kgcc/pair=8.141 kWh	Leather uppers
2	Romania (5 companies)	1.9 (0.07-1.07)	Kgcc/ pair	Research Project 36/1988	Leather substitute uppers
3	ASICS, Japan – G-KAYANO17	5	KgCO 2	Manufacturing-focused emissions reductions in footwear production,2013, www.sciencedirect.com/science/article/pii/S0959652612006300	China Factory

[18]-[21]

Distribution of Carbon Emissions within the Production Chain
Non-leather upper materials



Other

Nike Air Pegasus 25, USA
inbound logistic + Packaging + design + retail

ASICS, Japan - Gel Kayano 17
Transport + end-of-life + use

Toms, USA
consumption + transportation + retail + packaging + waste + design

3. The updated plan of the energy audit

Sectorial and process-related benchmarks will be defined, according to quantitative and qualitative analyses and to inputs received.

The basic elements and **calculation methodologies** for benchmark definition in both sectors were agreed (during Porto Meeting) on expressing the consumption as:

TANNING SECTOR

Product specific energy consumption: primary kWh consumed/square meter of finished leather

FOOTWEAR SECTOR

Product specific energy consumption: primary kWh consumed/pair of shoes

Factors that partners agree to be influencing the energy consumption (and therefore to be considered for benchmarks definition) include:
For Tanning sector:

- type of leather produced (animal type and destination of use);
- type and kind of process cycle applied & raw material processed;
- process phases carried out within the company.

For footwear sector product as a function of:

- destinations/end-user
- utilization
- assembling technology
- uppers' material
- process phases carried out within the company.

"It has been clarified that in both sectors, energy consumptions have to be evaluated within the factory borders (the so called "gate to gate" approach. No energetic consumptions outside the factory shall be considered. Process phases subcontracted to third parties will be taken into consideration in benchmark definition but not in the definition of improvement areas for single companies." [2]

Based on these will be produced the deliverable 2.3 "Benchmark for energy performances in tanning and footwear industries" - CTCP for footwear and CR&S for tanning sector benchmarks.

In order to improve the common understanding on operative procedures for audit execution, due to the importance perceived by the partnership of the moment of Energy Audit execution, which is conceived not only as a mere data collection, but

also as a very important moment for effective promotion of energy efficiency investments and non-cost measures, in 12 Months Meeting in Porto was adopted the Decision 2.4.
The minimum set of knowledge and tools for a correct audit execution shall therefore include:

- Knowledge and procedures on generic audit execution (i.e ISO 19011)
- Energy efficiency specific procedures for audit execution (i.e ISO 50001)
- Knowledge on the Set of organisational tools produced by SOGESCA (WP2)
- List of sector specific technologies with good potential in Energy Efficiency (WP3)
- List of cross cutting technologies with better potential for energy efficiency (WP3)
- Consolidated standards for Reporting after the Audit (WP2)
- Consolidated version of the Investment plans calculations templates (WP5)

Identifying these problems the following corrective actions were taken in this period:

- Production of a general procedure for Audit execution, including templates for reporting (SOGESCA);
- Organisation of the „Energy Audit: Training & Execution Meeting" in Bucharest Romania, 4-5 July 2013.

In this Meeting participated 19 specialists from 5 countries and were realized:

- On 04.07.2013: training & execution of audit in a footwear company (PROCOMOD);
- On 05.07.2013: execution of audit in a tanning company (PIELOREX).

- Revise the timing of the Task 2.4: Audits: new deadline: month 24 (April 30th 2014).

- According to the Decision 2.3 from 30 Month Meeting – Sofia, the audits will continued till the end of February 2015 and also more questionnaires will be collected (during audit activity) in order to review the benchmarks for tanneries (new term 15.03.2015).

4. Proposed companies grading and communication system

With benchmarking rules for the EU-Product Environmental Footprint Leather Pilot Screening Survey imminent, UNIC proposed semi-quantitative grading system at Project - Final Meeting in Brussels as follows:

Grading for Energy Consumption (EC):

EC-A: All companies with EC EnPIs within the range of average calculated ± 30%. These values have been calculated and reported in the Tannery Benchmark revised in March 2015.
EC-A+: Companies with EC-EnPIs lower than the low value of the range as above

EC-B: Companies with EC-EnPIs higher than the upper value of the EnPIs as above.

Grading for GHGs emissions:

Grading is necessary not only for EC, but also for CO2-eq. emissions. Depending on energy carrier used we may have cases were grading for one EnPI is as above, but the second one - CO2-eq. emissions - is out of the specified range.

At this point, if necessary, are proposed two grading sets namely one for EC and one for CO2-eq. emissions.

Along these lines the rules employed for the second grading will be:

GHG-A; GHG-A+ and GHG-B.

Grading for Energy Efficiency (EE):

When both grades obey by the grading system then is proposed to use a unique grading system:

EE-A, EE-A+ and EE-B, accordingly.

The proposed grading system will be implemented during the Task 2.3 Benchmark definition and reported in Deliverable 2.3 Tannery Energy Efficiency Benchmark.

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