ENVIRONMENTAL PRODUCT DECLARATION (EPD) CERTIFIED

Tuborg® Beer

International EPD® operated by The International EPD Consortium (IEC)
CPC code: 24310 – Beer made from malt (http://unstats.un.org/unsd/cr/registry/regcs.asp?Cl=9&Lg=1&Co=24310)
Geographical scope of application: Europe
Environmental Product Declaration Certificated – Registration Number: S-P-00311
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1. SCOPE OF THE DECLARATION

This document, known as an EPD (Environmental Product Declaration), is aimed at those interested in understanding and verifying the environmental impact generated through the entire life cycle of Tuborg® beer. The document provides a reliable quantification and certification of the environmental performance of the product, according to a scientific methodology that contemplates the impacts of the product's life cycle, the Life Cycle Assessment – LIFE CYCLE ASSESSMENT (ISO 14040-14044).

2. COMPANY DESCRIPTION

The story of Carlsberg Italy dates back almost two centuries to 1876, when Angelo Poretti founded the Induno Olona establishment that took the name Poretti Industries.
It was only after the war that Poretti industries, one of the cornerstones of beer production in Italy, attracted the interest of an international group that in the 1970s began to broaden their horizons: the United Breweries Group A/S (which later took the name of the Carlsberg Group), was born from the merger in 1970 of two historical Danish companies, Carlsberg and Tuborg. In 1975 the industries signed with the Danish group the first agreement for the production and marketing of the Tuborg and Carlsberg brands.
This innovative agreement proved decisive for the fortune of Poretti industries, as the Carlsberg Group acquired the company's shares over the years and in 1998 became Carlsberg Italy, and in 2002 became wholly Danish.
Today, Carlsberg Italy manufactures and sells approximately 1 million and 500 thousand hectolitres of beer through the following brands: Carlsberg, Tuborg, BAP 4 Luppoli Originale, BAP 5 Luppoli Bock Chiara and BAP 6 Luppoli Bock Rossa, Kronenbourg 1664 (covered by certified EPDs), Carlsberg Elephant, Carlsberg Special Brew, Tuborg Light, Corona-Extra, Splügen, Holsten, Tucher, Negra Modelo, Modelo Especial, Devil's Kiss, Super Devil's Kiss, Grimbergen and Feldschlösschen.
Carlsberg Italy, moreover, through the acquisition of numerous companies of beverage distributors throughout Italy, has created Carlsberg Ho.Re.Ca, the distribution network dedicated to the Ho.Re.Ca (*Hotellerie-Restaurant-Café*) channel that offers an extensive catalogue of products and services able to meet all the various needs and strategies of sales outlets.

Since February, 9th 2005 the production factory of Induno Olona, in which are produced Carlsberg Italia beers, has incorporated an environmental management system conforming to ISO 14001: 2004, certified by Lloyds's Quality Assurance register (certificate of approval No.: LRC 141249/14).
The environmental management system applies to:
"the production of beer from the receiving of raw materials up to the consignment of the finished product to the pallet".

3. PRODUCT DESCRIPTION

3.1. Characteristics

The characteristics of the product covered by this statement is the beer brand Tuborg®, produced by Carlsberg Italy at its plant in Induno Olona and intended for sale at pubs, bars, restaurants and points of sale of mass retail channels.
The identifier of the product according to the classification CPC (Central Product Classification) is: Beer made from malt – CPC 2431.

The same product is evaluated in three different distribution scenarios:

- Draught Master Modular 20 (DM Modular 20) kegs of 20 l;
- Disposable glass bottles of 33 cl, in selling unit of 3 bottles for mass retail channel
- 33cl and 50 cl aluminium cans

For the three distribution scenarios, the shelf life of the beer within specific containers was considered as follows:

- 9 months for beer stored in DM Modular 20 kegs;
- 15 months for beer in glass bottles.
- 12 months for beer in aluminium cans.

Regarding the annual consumption of beer per year, the size of the container, as well as the shelf life have an impact on the quantity of product purchased from outlets, and therefore on the frequency of supply of each store.
The composition of the product as supplied in three different containers, is as follows:

DM Modular 20 keg (100 l – 5 kegs)		
Beer[1]	100	95,3%
Keg (78% PET, 21% PP, other <1%)	1,50	1,4%
Packaging (paperboard)	3,375	3,2%

Glass bottle – Mass retail channel/Ho.Re.Ca (100 l – 303 bottles)		
Beer[1]	100	59,1%
Bottle (glass, 80% recycled)	60,61	35,8%
Cap POC (aluminium)	0,38	0,2%
Label (paper)	0,16	0,1%
Packaging for selling unit (paperboard) - 261 g for 24 bottles	3,30	1,9%

33cl Can (100 l - 303 Cans)		
Beer[1]	100	95,0%
Can (aluminium, 50% recycled)	3,21	3,1%
Cap (aluminium)	0,82	0,8%

50 cl Can (100 l - 200 Cans)		
Beer[1]	100	95,0%
Can (aluminium, 50% recycled)	4,18	4,0%
Cap (aluminium)	0,82	0,8%

[1] Beer density assumed to be 1kg/l

Tray (paperboard) – 80 g for 24 cans	1,01	1,0%
Shrink wrap (PE) – 21,5 g for 24 cans	0,27	0,3%

Tray (paperboard) – 80 g for 24 cans	1,01	1,0%
Shrink wrap (PE) – 25 g for 24 cans	0,32	0,3%

3.2. Functional Unit

The functional unit is represented by **100L of beer drummed/bottled and delivered to final consumers** (pubs, bars, restaurants, mass retail channel points of sale).
The functional unit is based on the production during the reference year 2016, and represents the reference unit of all results of this Declaration.

3.3. Declaration of Contents

Tuborg is a beer of low fermentation, belonging to the Lager segment –Europils sub-segment[2]. It is characterized by its purity and drinkability. It is known for its dry taste, and also by a reduced bitterness which remains present during the entire drinking experience, making it particularly thirst-quenching[3]. The product characteristics are as follows:

PRODUCT CHARACTERISTICS	
COMMERCIAL CAT.	Premium
LEGAL CAT.	Beer
STYLE	Lager
COLOR TYPE	Light
FOAM	Fine
ASPECT	Limpid
COLOR	Pale straw
AROMA INTENSITY	Normal
AROMA ELEGANCE	Normal
CARBONATION	Moderate
BODY	Light
BITTERNESS	Moderate
BALANCED TASTE	Bitter Oriented
STRENGTH OF AFTERTASTE	Normal
DURATION OF AFTERTASTE	Short
RAW MATERIALS	Water
	Barley Malt
	Maize
	Hops

PRODUCT SPECIFICS	
ALCOHOL CONTENT	5.0% alc. vol.
ATTENUATION	70%
REAL EXTRACT	3.40%
COLOR	7.5
BITTER UNITS (BU)	19

NUTRITIONAL INFORMATION PER 100 ml OF PRODUCT	
ENERGY	42 kcal (175 kJ)
PROTEIN	0.3 g
FAT	0.0 g
CARBOHYDRATES	3.5 g

[2] Beer light in colour (<12 EBC - *European Brewery Convention: conventional unit to measure beer colour)*, made from light lager malt and sometimes adjunct (rice, corn, sugar, etc.), medium flavour, bitterness around 20 BU (16-27 BU)
[3] All characteristics reported in this chapter refers to a classification used in beer world, developed by a trade magazine in 1994 with Assobirra partnership and with brewer technician association AITB support.

3.4. Description of the Production Process

Beer production can be divided into three main phases: cooking the wort, fermentation and filtration.
During the first stage, which takes place in the cooking room, the barley malt is milled until a certain type of flour is obtained. This is then mixed with hot water, thereby obtaining the wort (the brew).
The liquid part of the wort is separated from the solid part through filtration and grains, through which a waste product is obtained, recovered and sold on as animal feed. In this respect, the environmental impacts associated with the percentage of barley malt, which contributes to the production of spent grains, have already been allocated and therefore are not borne by the present LCA study. Allocation of environmental impacts of spent grains is based on mass.
The next step is to filter the wort cooking inside appropriate boilers. This is essential for the type of beer to be produced and the sterilization of the wort. It is during this phase that hops are also added. During boiling, insoluble complexes are formed that constitute the so-called trub, that is eliminated through clarification.
The next stage is that of fermentation. The wort is cooled down to temperatures which allow fermentation to occur, oxygen is then injected in the process at an early stage, which takes place under aerobic conditions.
Next is the addition of yeast and the fermentation process itself. From this process we have the production of CO2, which is almost entirely recovered to be used in other production phases in which it is required.
At the end of fermentation, the beer is left in maturing tanks so that residues of yeast can settle on the bottom.
The final phase is that of filtration, where the beer undergoes a series of operations to remove residues of yeast and other murky substances present, therefore, such a stabilisation process is designed to make the beer unalterable before being drummed or bottled.

3.5. The Boundaries of the Analysed System

The system boundaries analysed in the LCA study include all phases of the life cycle of production of beer, from the cultivation of ingredients to the disposal of kegs and bottles after consumption.

In particular, the system includes the following life cycle phases:

- "upstream processes[4]":
    - the production phase of kegs, bottles and cans (including all related packaging materials, of all typologies and with the highest degree of detail achievable);
    - the production phase and transport of raw materials and ancillary materials for the beer production process;

- "core processes":

[4] In the "General Programme Instructions" of the international EPD ® IEC (www.environdec.com) "upstream processes" are considered as those which include the acquisition of raw materials and semi-finished or intermediate components, "core process" those undertaken in the establishment of production of products covered by the EPD, "downstream processes" processes related to the use phase and end of life scenario.

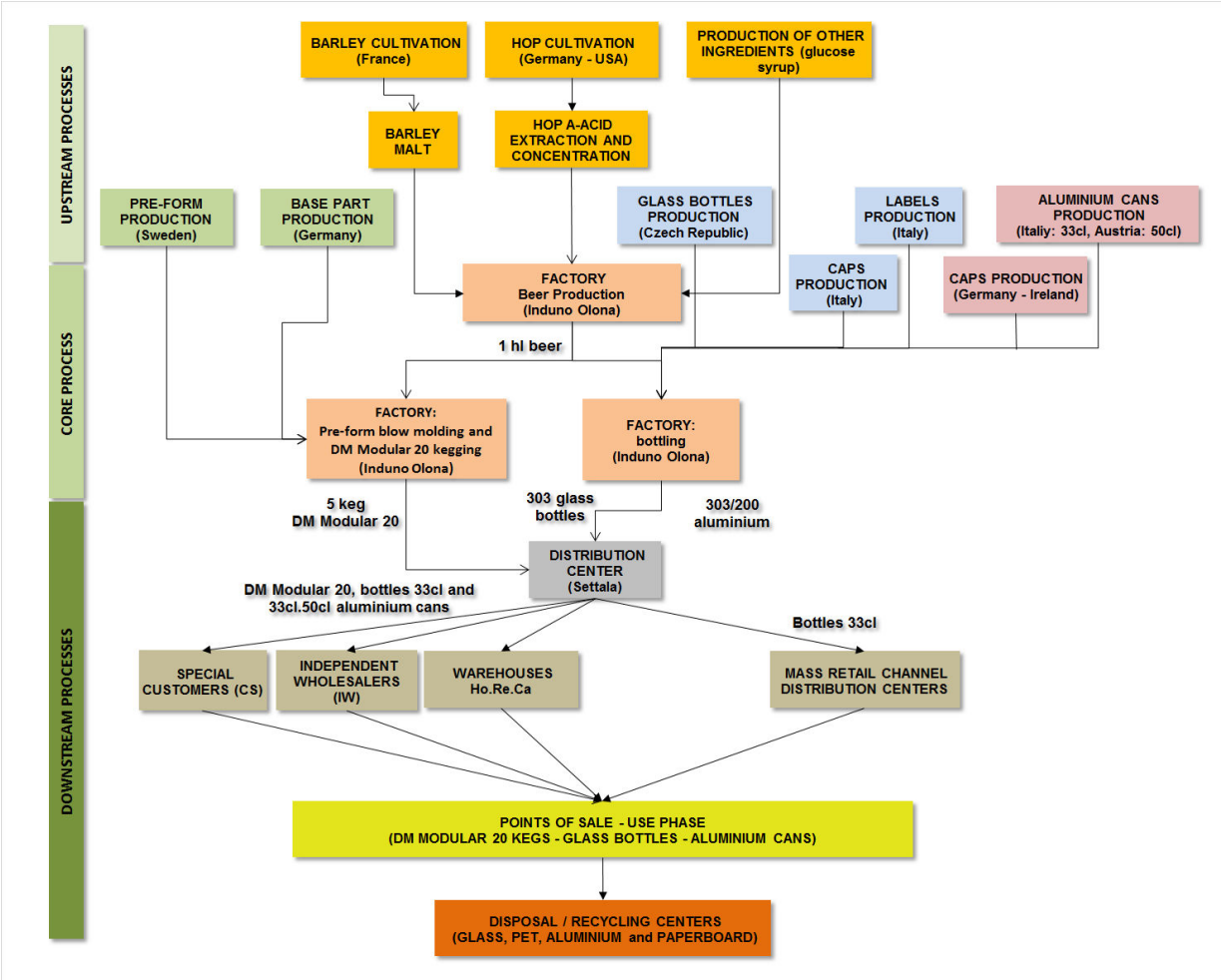
- the beer production phase;
- the beer kegging and bottling phases;
- transport of all the input of the production process;

- "downstream processes":
  - the phases of distribution of the finished product;
  - maintenance activities of plants located at final points of sale;
  - consumption occurring during usage phase of beer lines, included cooling of the product;
  - the end of life phases (transport to disposal and collection centres, landfill disposal and potential recovery of materials and energy[5]).

Emissions associated to production of used electricity are ascribed to phases where consumption occurs.
Excluded from the system boundaries are the environmental loads associated with construction and maintenance of production facilities.
To assure the homogeneity of the results, a unique distribution scenario of finished product has been adopted, defined on the base of weighted average distances for each route on all distribution channels actually used during the reference year. For the reported brand, the total distribution distance is 451 km.

The boundaries of the system are schematically represented in the figure below:

[5] For plastic, glass, paper and aluminium end of life scenarios, national percentages published in the annual Sustainability report of Consorzio Nazionale Imballaggi (CONAI) (data 2016) were used.



3.6. Time Periods and Data Sources

The comparability between EPDs of different products must also be ensured on the basis of time. To this end, it is clarified that the LCA study that gave rise to this EPD refers to the production of beer Tuborg® in the establishment in Induno Olona in one calendar year. The base year for the data and indicators presented in this EPD is 2016.

The data used for the LCA were directly measured at the establishment of Induno Olona and supplied directly by the main suppliers of the plant. According to *General Programme Instructions* "other generic" data do not exceed 10%.

Excluded from the system, due to their contribution lower that 1% on total impacts, are:

- The supply of yeast;
- Additives of the beer recipe.

4. DECLARATION OF ENVIRONMENTAL PERFORMANCE

All data quantities below relate to the functional unit chosen for the EPD: 100L of beer bottled/barrelled and delivered to final consumers (at pubs, bars, restaurants). Since the PCR (Product Category Rules) were updated, the results reported in the current EPD cannot be compared to previous versions.

Reported data for glass bottles refer to sales format for both Ho.Re.Ca channel and mass retail channel.

Reported data for aluminium cans refer to 33cl and 50 cl formats.

✓ **RESOURCES USE**[6]

		DM Modular 20 kegs	Glass Bottles	Aluminium Cans
NON RENEWABLE RESOURCES				
Material Resources	**kg**	**6,851**	**36,117**	10,782
Of which:				
Gravel	kg	4,617	25,51	5,724
Calcite ($CaCO_3$)	kg	0,9616	5,01	1,357
Iron	kg	0,3908		
Sodium Chloride	kg	-	2,11	-
Aluminium (Al)	kg	-	-	2,152
Resources for Energy Conversion Purposes	**kg**	**18,56**	**35,234**	**25,450**
Of which:				
Gas	kg	5,798	14,95	7,643
Coal (hard)	kg	5,299	7,396	8,525
Oil	kg	4,787	10,14	5,745
Coal (brown)	kg	2,659	2,725	3,530
RENEWABLE RESOURCES				
Material Resources	**kg**	**1,103**	**3,468**	**1,040**
Of which:				
Wood	Kg	1,102	3,450	1,039
Resources for Energy Conversion Purposes	**MJ**	**309,7**	**343,4**	**359,3**
Of which:				
Biomass	MJ	250,9	269,3	240,0
Hydroelectric	MJ	35,39	50,66	96,23
OTHER INDICATORS				
Secondary resources, material	**kg**	**3,49**	**55,85**	**2,96**
Secondary resources, energetic	**MJ**	**0,00**	**0,00**	**0,00**
Recovered energy flows	**MJ**	**0,00**	**0,00**	**0,00**
GER (Gross energy requirement)	**MJ**	**1143,01**	**1936,75**	**1446,54**
Water	**l**	**1196,15**	**1456,06**	**1236,11**

[6] Resources use data unbundled in *upstream processes*, *core process* and *downstream processes* are reported in **Annex 1**

Of which, direct in "core"	l	**364,4**	**399,60**	**395,79**

NOTE: the table shows individually the resources that contribute at least 5% of the total for each **subcategory**. Difference between total value of subcategory and the sum of single resources is due to resources that individually contribute for less than 5%. Secondary resources completely refer to "upstream" processes.

✓ **POTENTIAL IMPACTS**

BEER IN DM MODULAR 20 KEG				
Impact Categories	**Total Life Cycle**	***Upstream processes***	***Core process***	***Downstream Processes***
Global Warming Potential (kg CO_2 eq.)	**50,20**	18,52	8,43	23,25
Acidification Potential (kg SO_2 eq.)	**0,25**	0,12	0,03	0,10
Photochemical Ozone Creation Potential (kg C_2H_4 eq.)	**0,018**	0,011	0,001	0,005
Eutrophication potential (kg $PO4^{-3}$eq.)	**0,122**	0,104	0,007	0,012

BEER IN GLASS BOTTLE				
Impact Categories	**Total Life Cycle**	***Upstream processes***	***Core process***	***Downstream Processes***
Global Warming Potential (kg CO_2 eq.)	**109,16**	66,84	12,54	29,78
Acidification Potential (kg SO_2 eq.)	**0,56**	0,39	0,03	0,13
Photochemical Ozone Creation Potential (kg C_2H_4 eq.)	**0,030**	0,021	0,002	0,007
Eutrophication potential (kg $PO4^{-3}$eq.)	**0,160**	0,133	0,008	0,019

BEER IN ALUMINUM CAN				
Impact Categories	**Total Life Cycle**	***Upstream processes***	***Core process***	***Downstream Processes***
Global Warming Potential (kg CO_2 eq.)	**72,07**	33,96	15,65	22,46
Acidification Potential (kg SO_2 eq.)	**0,34**	0,21	0,03	0,10
Photochemical Ozone Creation Potential (kg C_2H_4 eq.)	**0,026**	0,019	0,002	0,005
Eutrophication potential (kg $PO4^{-3}$eq.)	**0,127**	0,108	0,007	0,012

✓ **OTHER INDICATORS**

WASTE PRODUCTION

		DM Modular 20 keg	Glass bottle	Aluminium can
Total	**kg**	**7,433**	**26,064**	**7,364**
of which:				
non hazardous	kg	7,431	26,059	7,320
hazardous	kg	0,002	0,008	0,044
total radioactive waste	kg	-	-	-

USE OF RECYCLED PACKAGING MATERIAL

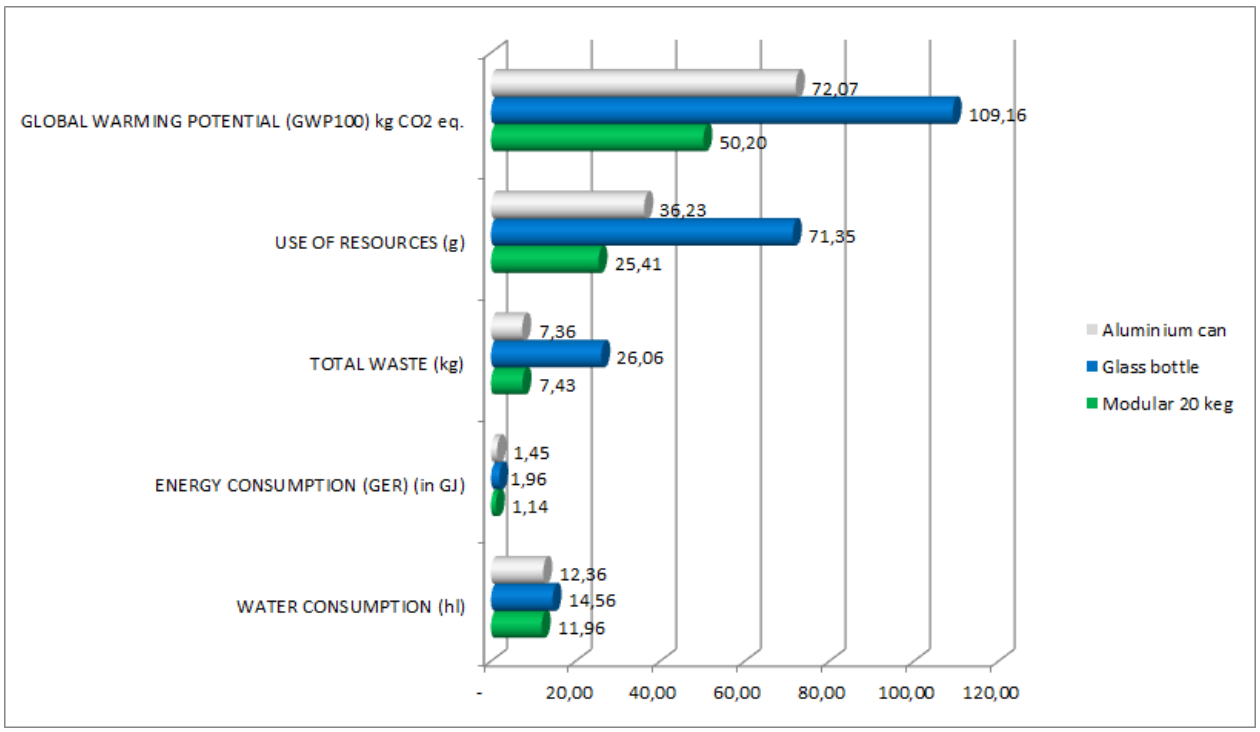
BEER IN DM MODULAR 20 KEG	**Cardboard (kg)**	3,49
BEER IN GLASS BOTTLE	**Glass (kg)**	55,85
BEER IN ALUMINUM CAN	**Aluminium (kg)**	2,96

5. INTERPRETATION OF THE RESULTS

The chart and graph shown below are useful to understand the environmental performance related to the life cycle of the beer brand Tuborg® in the three distribution scenarios. It should be remembered that, for a strict comparison of environmental performance, indicators noted above should be compared with those related to competing products referring to the same functional unit.

	Glass Bottle	DM M20 Keg	Aluminium Can	DM M20 Keg
Resources Consumed (kg)	71,35	25,41	36,23	25,41
		-64,39%		**-29,87%**
Water Consumption (litres)	1.456,06	1.196,15	1.236,11	1.196,15
		-17,85%		**-3,23%**
Energy Consumption (MJ)	1.963,75	1.143,01	1.446,54	1.143,01
		-41,79%		**-20,98%**
Global Warming Potential (Gwp100) (Kg CO_2 Eq)	109,16	50,20	72,07	50,20
		-54,01%		**-30,34%**
Total Waste (Kg)	26,06	7,43	7,36	7,43

		-71,48%		0,93%



6. INFORMATION FROM THE ORGANISATION

The distribution technology in DM Modular 20 kegs in PET is associated with new dispensing equipment developed by Carlsberg Italy that replaces that traditionally used. Whilst the latest kegs dispense beer through applying CO_2 pressure inside the kegs, DM Modular 20 technology provides for the application of air pressure outside the body, thereby eliminating the use of CO_2 cylinders.

Managers of final sales outlets must dispose of the DM Modular 20 kegs, once exhausted, in the differentiated recycling of plastics, according to the directions of the local authorities. There is currently no system for returnable glass bottles, which must be disposed of in separate glass recycling as indicated by the local authorities.

Carlsberg Italy s.p.a., in accordance with the commitments set out in its environmental policy, approved under the environmental management system certificate ISO 14001, aims at pursuing pollution prevention, minimization of environmental impacts linked to production processes, optimizing the use of natural resources and continuous improvement of its environmental performance, has extend the use of the innovative solution DM Modular 20 to all produced and marketed brands, thus enhancing the environmental performance, as demonstrated by data presented in this EPD.

At present Carlsberg Italy s.p.a. has undergoing studies on new distribution opportunities of finished product through PET kegs of different dimension, subjected to Life Cycle Design studies, to limit environmental impacts of product life cycle.

7. INFORMATION FROM THE CERTIFICATION BODY

This EPD was approved by the certification body RINA Services S.p.a. (www.rina.org), accredited from ACCREDIA (Registration Number 001H), in compliance with the requirements of the standard "General Programme Instructions" of the international system EPD ® IEC (*www.environdec.com*) and of PCR 2011:21.
RINA Services S.p.a is member of international certification network IQNet (*www.iqnet-certification.com*).

PCR Review conducted by: Technical Committee of the International EPD System e-mail: info@environdec.com
Independent audit of declaration and data, in compliance with standard ISO 14025:2006 □ EPD process certification X EPD verification
Third party auditor: Rina Services S.p.A., Via Corsica 12, 16128 Genova, Italy, Tel: +39 010 53051, Fax: +39 010 5351000, www.rina.org ACCREDIA Registration number: 001H

It should be remembered that EPD developed according to different programmes may not be comparable.
This EPD and all regarding information are available on website: www.environdec.com.

8. REFERENCES

For LCA study and EPD declaration fulfilment, the following documents were used:

- General Programme Instructions (GPI) for Environmental Products Declarations (Version 2.5);
- PCR 2011:21 (Version 2.0);
- UN CPC 24310: Beer made from malt;
- LCA Analysis and Comparison between Distribution Scenario of Carlsberg, Tuborg, BAP 4 Luppoli Originale, BAP 5 Luppoli Bock Chiara and BAP 6 Luppoli Bock Rossa Beers, Kronenbourg (06/03/2018, Rev. 2);
- Databases required from reference PCR;
- ELCD Database - *European Life Cycle Database* (Version 2.0) (http://lca.jrc.ec.europa.eu);
- *Ecoinvent 3.3* Database (http://www.ecoinvent.ch);
- Agrifootprint 3.0 Database (http://www.agri-footprint.com)
- "*The Carbon Footprint of Fat Tire® Amber Ale*", *THE CLIMATE CO_2NSERVANCY.*

For disposal of kegs and bottles within differentiated waste collection, managers of final sales outlets must refer to directions of local authorities
Contacts for environmental product declaration:

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In realizing this EPD and the LCA study, which forms the scientific basis, Carlsberg Italia S.p.a. avails itself of technical and methodological support of a research team of **IEFE – Università Bocconi of Milan**, composed by **Prof. Fabio Iraldo** and **Doc. Matteo Donelli**.

9. GLOSSARY

LCA: Life Cycle Assessment is a methodology governed by the ISO 14040 series that aims to quantify the energy and environmental load of the life cycle of a product or activity, through the quantification of energy and waste materials and emissions (solid, liquid and gaseous) released into the environment from the extraction of raw materials to final waste disposal.

FUNCTIONAL UNIT: is the measurement unit to which all results listed in the EPD refer. That measurement serves as the basis for comparison to compare the data presented in two or more EPD's for products belonging to a specific category of homogeneous goods/services, i.e. the same PCR.

GREENHOUSE EFFECT: atmosphere global warming phenomenon, calculated for the next 100 years, due to the emission into the atmosphere of greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), nitrogen protoxide (N_2O), etc.

ACIDIFICATION: lowering the pH of the soil, lakes, forests, due to the release of acidic substances into the atmosphere, with harmful effects on living organisms (e.g. "acid rain")

EUTROPHICATION: the reduction of required oxygen in water bodies and ecosystems due to the excessive intake of nutrients such as nitrogen and phosphorus

PHOTOCHEMICAL OZONE CREATION POTENTIAL: formation of ozone in the earth's surface due to the release into the atmosphere of unburnt hydrocarbons and nitrogen oxides in the presence of solar radiation. This phenomenon is harmful to living organisms, and is often found in large urban centres

GROSS ENERGY REQUIREMENT (GER): is an indicator, expressed in MJ or kWh, of the total energy extracted from the environment throughout the entire life cycle of a functional unit of a product/service. Contributing to this indicator are dimensions of energy consumed for manufacturing processes to produce fuels used in processes, for the phases of transport, in addition to the share of energy contained and "frozen" in potentially combustible materials.

SHELF LIFE: The length of time a food product can be preserved, that is the time, after packaging, a product, remains safe in pre-defined environmental conditions.

ANNEX 1 – Resources Use in three distribution scenarios unbundled in *Upstream Processes, Core Process* and *Downstream Processes*

		BEER IN DM MODULAR 20 KEG				BEER IN 33cl GLASS BOTTLE				BEER IN ALUMINIUM CAN			
		Full Life Cycle	Upstream Processes	Core Process	Downstream Processes	Full Life Cycle	Upstream Processes	Core Process	Downstream Processes	Full Life Cycle	Upstream Processes	Core Process	Downstream Processes
NON RENEWABLE RESOURCES													
Material Resources	kg	**6,851**	2,321	2,400	2,130	**36,117**	27,370	4,550	4,197	**10,782**	6,969	2,217	1,597
Res. for En. Conversion Purposes	kg	**18,559**	6,437	3,296	8,827	**35,234**	19,776	4,276	11,182	**25,450**	11,323	5,458	8,669
RENEWABLE RESOURCES													
Material Resources	kg	**1,103**	0,3757	0,166	0,561	**3,468**	2,715	0,169	0,584	**1,040**	0,328	0,155	0,557
Res. for En. Conversion Purposes	MJ	**309,678**	248,518	12,142	49,018	**343,431**	306,029	11,858	53,386	**359,322**	299,267	11,117	48,939
WATER													
Water	l	**1196,15**	764,24	364,38	675,53	**1456,06**	980,61	399,60	75,85	**1236,11**	775,14	395,79	65,18

Note: possible inconsistencies in decimal numbers between the total use of resources in column "*Full Life Cycle*" and the sum of the three disaggregated values "*upstream processes*", "*core processes*" and "*downstream processes"* are due to rounding of values to second decimal place.