timay & tempo

SINCE 1987

Process Comparison and Product Environmental Impacts by Life Cycle Assessment

October 2020

FASHION ACCESSORIES COMPANY

details
are
important

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About the Report

This report presents the environmental performance and their impacts of metal textile buttons manufactured by timay&tempo in their Amasya plant in Turkey. It follows ISO 14040 Life Cycle Assessment (LCA) standard as the calculation methodology.

LCA is a scientific tool for the evaluation of environmental effects of products and services through their life cycle, from cradle to end of life. This involves the extraction of raw materials, preparing of extracted raw materials, fabrication, transportation, use, recycling and disposal of the product, as well as the energy and ancillary materials supplies. An LCA provides us the opportunity to see how the products manufactured are affecting the environment.

The assessment is based on the LCA model developed from "gate to gate" boundary, i.e. for the manufacturing operations only, and the assessment was done with the data collected from timay & tempo production plant in 2019 for metal textile button products. Raw material supply, forming metal strips from raw material metal, and metal surface plating process are included in the system boundary. Both final product environmental impact and process comparison of the results for each product is presented in this report.

This study is commissioned by timay & tempo and conducted by Metsims Sustainability Consulting, a leading pan-European LCA consultancy operating in the UK, Turkey and the EU.

This summary report is based on comprehensive LCA report on the products presented in this report and peer reviewed by Vladimír Kočí, PhD, LCA Studio, Czech Republic.

Critical Review:

Vladimír Kočí, PhD
CEO Founder
LCA Studio

LCA Consultant:

Hudai Kara, PhD
Managing Director
Metsims Sustainability Consulting

About the Company

In order to serve textile and metal accessories sector, timay & tempo was founded in 1987 in Turkey.

Today, in terms of production and sales basis, it is one of the biggest suppliers in Europe and exports to more than 50 countries in the world.

It is a solution partner of the world's leading brands with its flexible, researching, creative attitude and fast service approach.

With its creative collections, which are created twice a year, it offers different styles and innovative approaches to the fashion industry. With more than 400 employees, customer-oriented strategies and creative perspective, the company's position in the market is strengthening day by day.

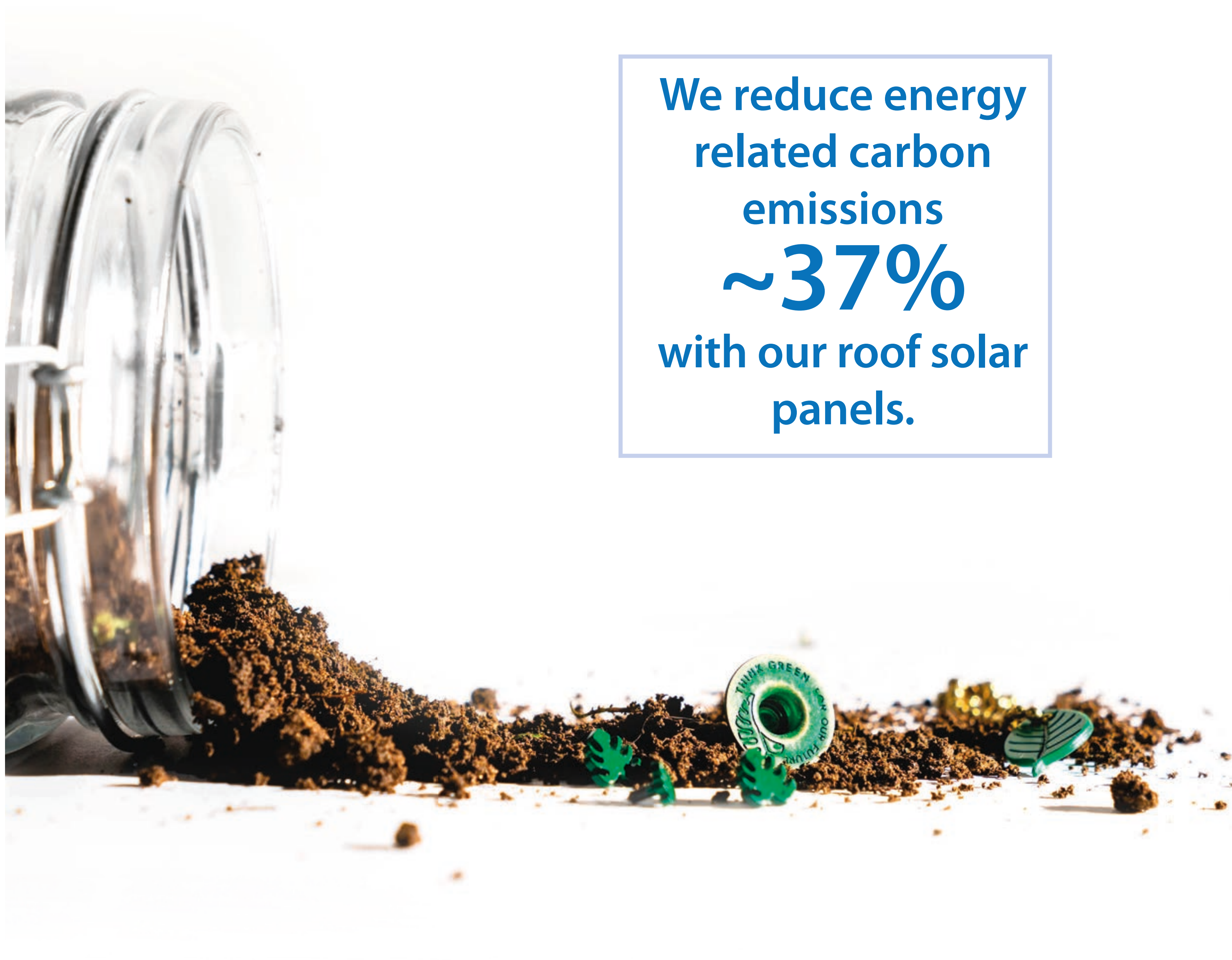
With R&D investments, innovation and technology-oriented infrastructure, understanding of sustainable and environmental-friendly production, establishing long term relations before and after sales forms its mission.

Always to be with customers by combining innovative, creative and customeroriented service concept with technological elements is unchangeable principle of timay & tempo.

Environmental Policy

Every individual in the organization structure of timay & tempo are aware of the requirement for taking the necessary measures and minimizing the negative effects on the environment at all stages of our processes as part of our sustainable development policy. All activities to be performed with this awareness are shaped in line with the environmental policies. Our company taking additional measures to make our society and environment a more livable place.

Our company aims at implementing the requirements of the international standards and legislations in our global industry. We have the following principles as a policy: recycling and/or re-utilizing the production waste so that its effect on the environment minimized and resources saved, if not possible, disposing it without causing any environmental pollution; identifying conditions with potential effects on the environment and reducing their risks; continuously working to improve the environmental management system to better protect the environment.



We reduce energy related carbon emissions

~37%

with our roof solar panels.

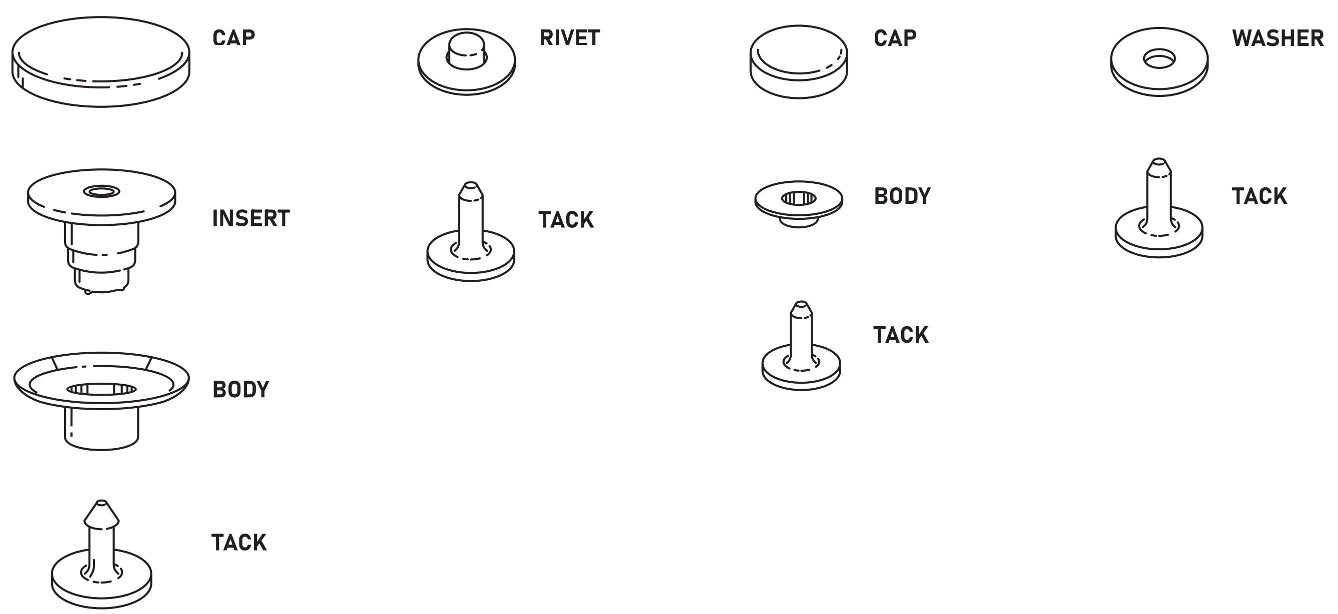
About the Products

Accessories are an important part of our daily clothing, providing extra value to clothes besides their functional structures.

Striking designs by timay & tempo add a smal yet special touch to its customers’s collections with modern, innovative materials, coatings and different accessories it manufactures.

timay & tempo combines the innovations within the industry with the trends and the seasonal accessory collections it prepares throughout the year and offers them its customers. The company makes a significant difference within the market due to its automatic and semi-automatic nailing machines used in the assembly of all its products.

timay & tempo Design Team supports with accessories designs to world renowned brands with its researcher, flexible, creative, and quick service. We widen our product range in fashion business with our season collections which are designed every year.



About the Environmentally-friendly Series

In its production, timay&tempo do not use conventional plating methods. We have committed to the reduction of energy, chemicals, process water and waste in all of our manufacturing activities. We have been developing new finishes by using washing, oxidation and ecological lacquering processes on copper, copper alloys, stainless steels, and aluminium metals to make our production more environmentally friendly and resource efficient. We do not utilize electro-plating processes in our production processes.

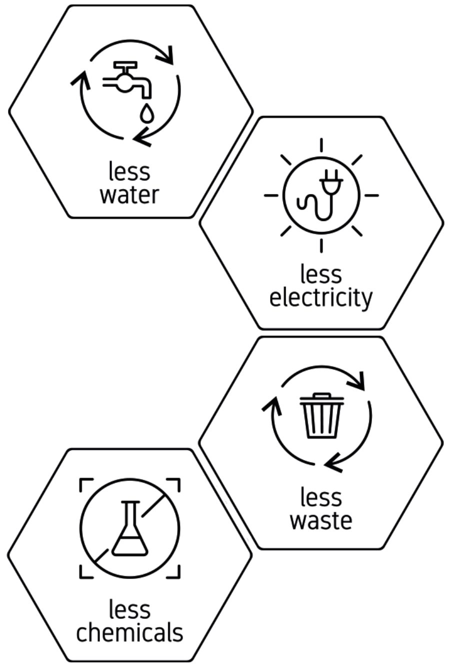
Our ecological oxidation finishes use low concentration of chemicals resulting in lower environmental impacts than that of conventional finishes.

We apply by using an environmental and user-friendly solvent developed by ourselves.

For colouring, we only use environmentally friendly water-based paint systems.

Process comparison evaluations per each product are calculated with LCA and given in the environmental profile section.

Eco Friendly Process   Conventional Process



We are developing new colours for our products by using different process which reduce the level of chemical consumption.

Responsible Finishing

Environmentally conscious design is in our DNA.

Not only we measure our environmental impacts but also we strive to improve product designs by continuously identifying hotspot in our production and manufacturing operations.

Life Cycle Assessment (LCA)

Background

Life Cycle Assessment (LCA) is best known for quantitative analysis of the environmental aspects of a product over its entire life cycle. An LCA is a systematic tool that allows for analysis of environmental loads of a product in its entire life cycle and assessment of their potential impacts on the environment. Product in this context include both products and services. Emissions to the air, water, and land such as CO_2, Biological Oxygen Demand (BOD), solid wastes, and resource consumptions constitute environmental loads. Environmental impacts in the LCA context refer to adverse impacts on the areas of concern such as ecosystem, human health and natural resources.

There are four phases in an LCA:

- goal and scope definition;
- life cycle inventory analysis;
- life cycle impact assessment; and
- life cycle interpretation.

LCA can assist in:

- identifying opportunities to improve the environmental aspects of products at various points in their life cycle;
- decision-making in industry, governmental or non-governmental organizations (e.g. strategic planning, priority setting, product or process design or redesign);
- selection of relevant indicators of environmental performance, including measurement techniques;
- marketing (e.g. an environmental claim, ecolabelling scheme or environmental product declaration).

Methodology

After collecting all relevant data for each of the life cycle stages, the modelling is conducted using SimaPro life cycle assessment software. SimaPro LCA software, developed by PRé Sustainability, is a professional tool to collect sustainability data and to analyse and monitor the sustainability performance of products and services. SimaPro can be used for life cycle assessment, sustainability reporting, carbon and water foot printing, product design, generating environmental product declarations, determining key performance indicators, and much more. SimaPro is ISO compliant software used by industry, consultancies, and research institutes in more than 80 countries.

All environmental indicators in this report are calculated with EF 3.0 method (adapted), version 1.00. The EF method is the impact assessment method of EU Products Environmental Footprint (PEF) initiative, an EU harmonised methodology for measuring the environmental impact of products. The implementation is based on EF method 3.0 published for use during the EF transition phase.

Production spesific primary data; raw materials, energy, water and chemical Consumption are collected from timay & tempo 2019 production year.

Definitions

Goal and Scope	Evaluation of environmental impacts of selected timay&tempo metal textile buttons
Declared Unit	The functional unit is a quantified performance of a product system for use as a reference unit in a life cycle assessment study. In this report, the declared unit is the production of 1 kg textile buttons manufactured by timay & tempo
LCA Software	SimaPro 9.1
Background Data	Ecoinvent LCA Database (ver. 3.6) and Turkish Life Cycle Inventory Database, TLCID* (ver. 1.0)
Assumptions	There are no additional product scenarios or estimates developed for this study.
Allocations	There are no co-products in the production. Hence, there is no need for co-product allocation. Only, amounts of wastewater and sewage sludge are allocted according to production tonnages in 2019.

* TLCID is used for emission factors of Turkish Electricity Country Mix. Calculated factors according to annual electricity production source and amount, reflect the generation values from 2019.

All electricity consumptions by the related manufacturing machines were specifically measured. The company provides about 36.6% of their elektricity needs from roof-top solar panels, and the remaining is provided from the country electricity network.

Raw materials and forming metal strips are included in the LCA system boundary. Transport related activities are not included due to the gate to gate system boundary approach.

No cut-off applied to the inventory, i.e. every materials are taken into account even their amount is less than 1%. All plating processes and their compositions are assessed in detail.

Environmental Profiles

Assessed Product Codes

Eco Friendly		Conventional	
Color Code	**Lacquer**	**Color Code**	**Lacquer**
E01.C01	VE02	C07.B03	V001
E01.B01	VE02	B09.B00	V001
E04.B00	VE02	B06.B03	V001
E04.B01	VE02	B06.B01	V001
E09.C00	VE02	C09.B04	V001
E09.C01	VE02	C09.B01	V001
E07.C02	VE02	D02.B02	V001
E10.B00	VE02	D01.B02	V001
E08.C00	VE02	C10.B01	V001
R01.A06	VE02	C16.B03	V001
E01.S02	VE02	C16.B04	V001
AK1.C00	VE02	W10.B00	V001
E10.B01	VE02	D01.B07	V001
E07.C03	VE02	L21.B01	V001
E01.C01	White Water Based Paint	C03.B00	White Solvent Based Paint
E09.C00	Black Water Based Paint	C09.B04	Black Solvent Based Paint
E01.S01	VE02	S03.S01	V001
C01.C00	VE02	C01.B00	V001

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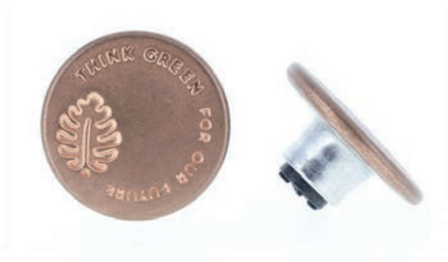
E01.C01



Raw Material	Copper
Plating	Non Plated
Oxidation	Non Oxidation (Only Rinse)
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

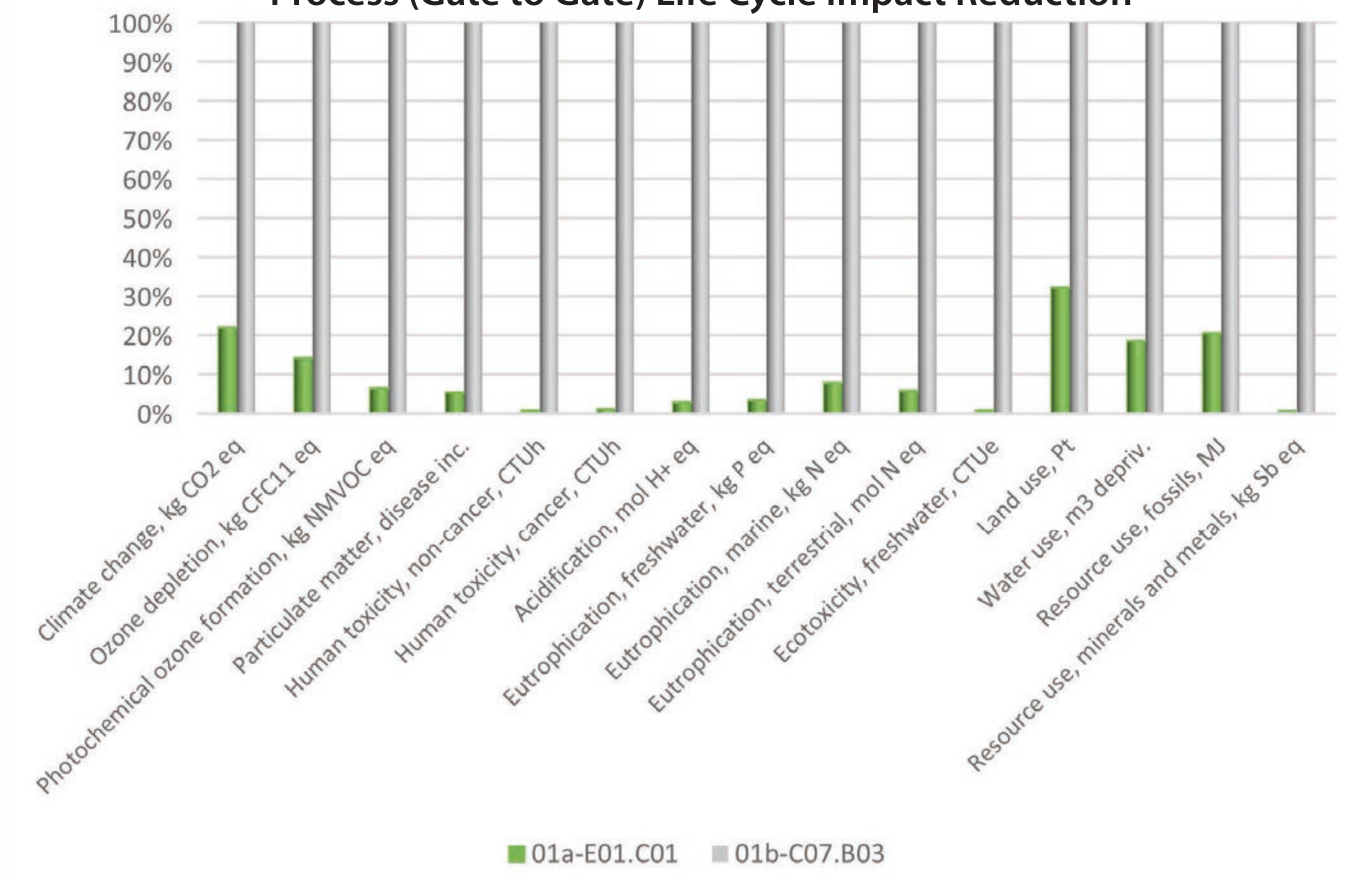
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.58 kg CO_2 eq.	**0.209** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
E01.C01 versus C07.B03

Carbon Footprint	Total Water Consumption
-78%	-79%
Total Energy Consumption	**Total Chemical Consumption**
-55%	-69%

Process (Gate to Gate) Life Cycle Impact Reduction



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E01.B01

Raw Material	Brass
Plating	Non Plated
Oxidation	Non Oxidation (Only Rinse)
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

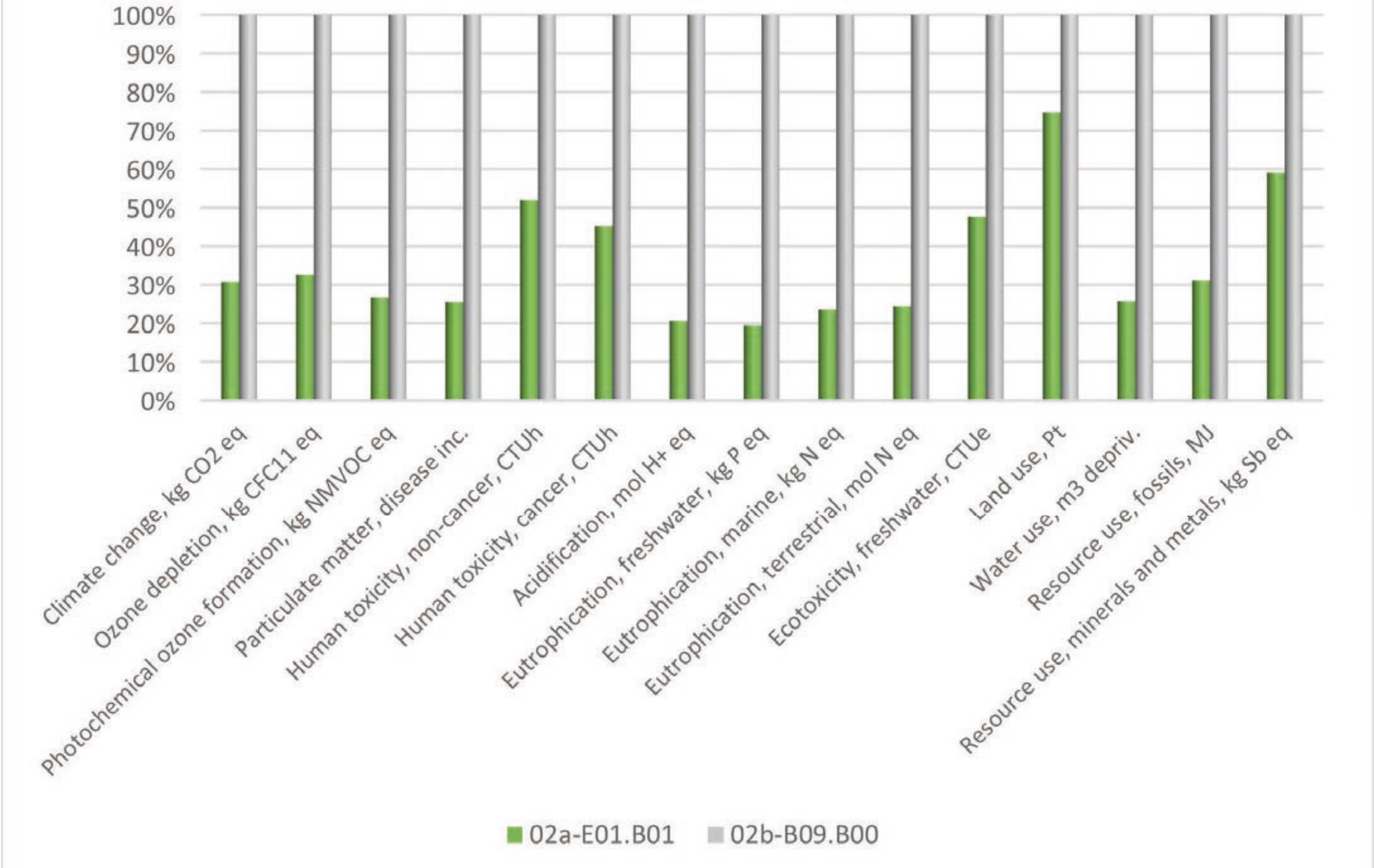
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.58 kg CO_2 eq.	**0.209** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
E01.B01 versus B09.B00

Carbon Footprint	Total Water Consumption
-69%	-76%
Total Chemical Consumption	Total Energy Consumption
-25%	-49%

Process (Gate to Gate) Life Cycle Impact Reduction



E04.B00

Raw Material	Brass
Plating	Non Plated
Oxidation	Eco Oxidation
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

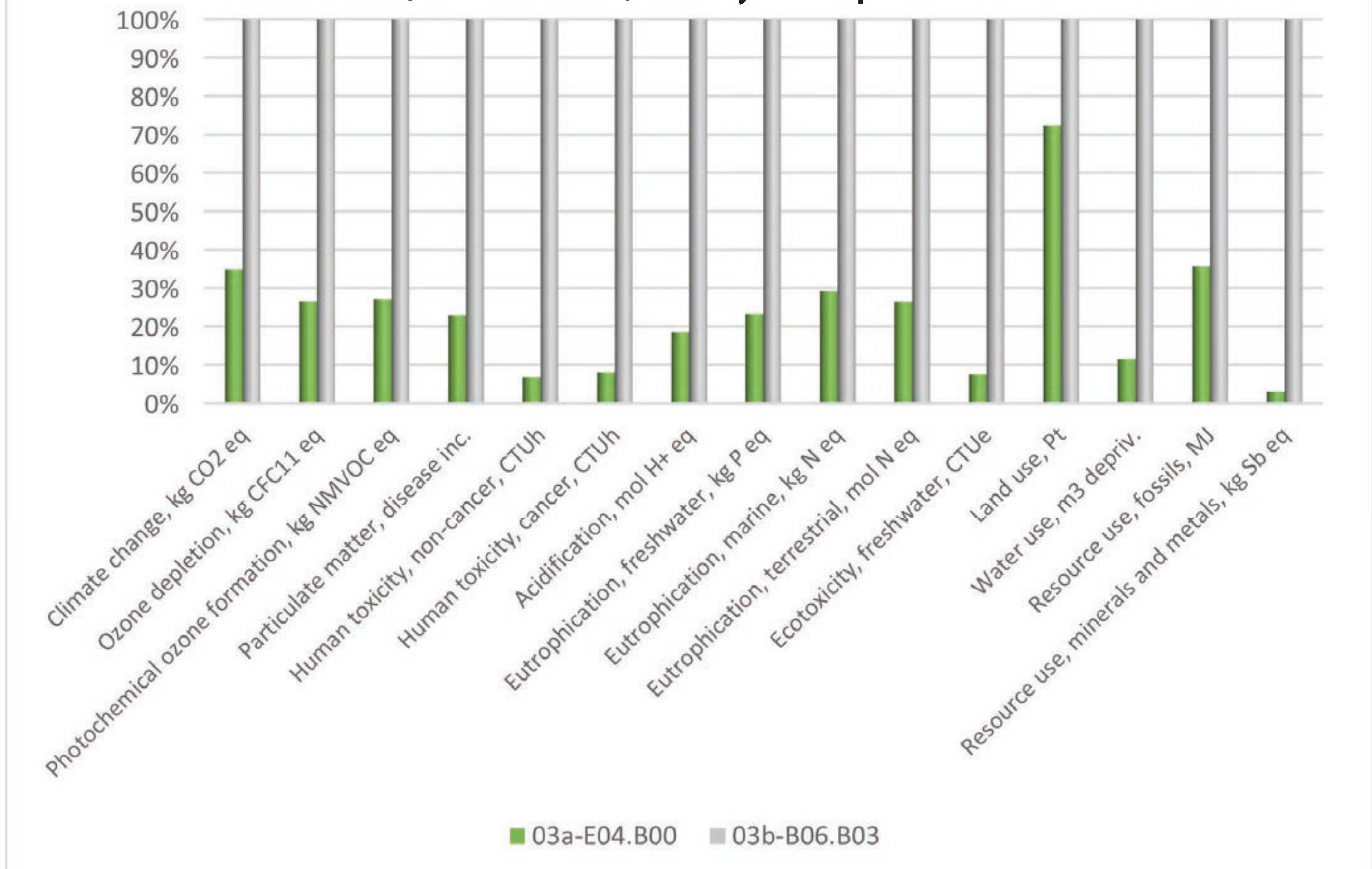
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.14 kg CO_2 eq.	**0.259** m^3
Freshwater Eutrophication	**Resource Depletion**
0.050 kg P eq.	**0.026** kg Sb eq.

timay & tempo Process Comparison:
E04.B00 versus B06.B03

Carbon Footprint	Total Water Consumption
-65%	-70%
Total Chemical Consumption	Total Energy Consumption
-51%	-29%

Process (Gate to Gate) Life Cycle Impact Reduction



E04.B01

Raw Material	Brass
Plating	Non Plated
Oxidation	Eco Oxidation
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

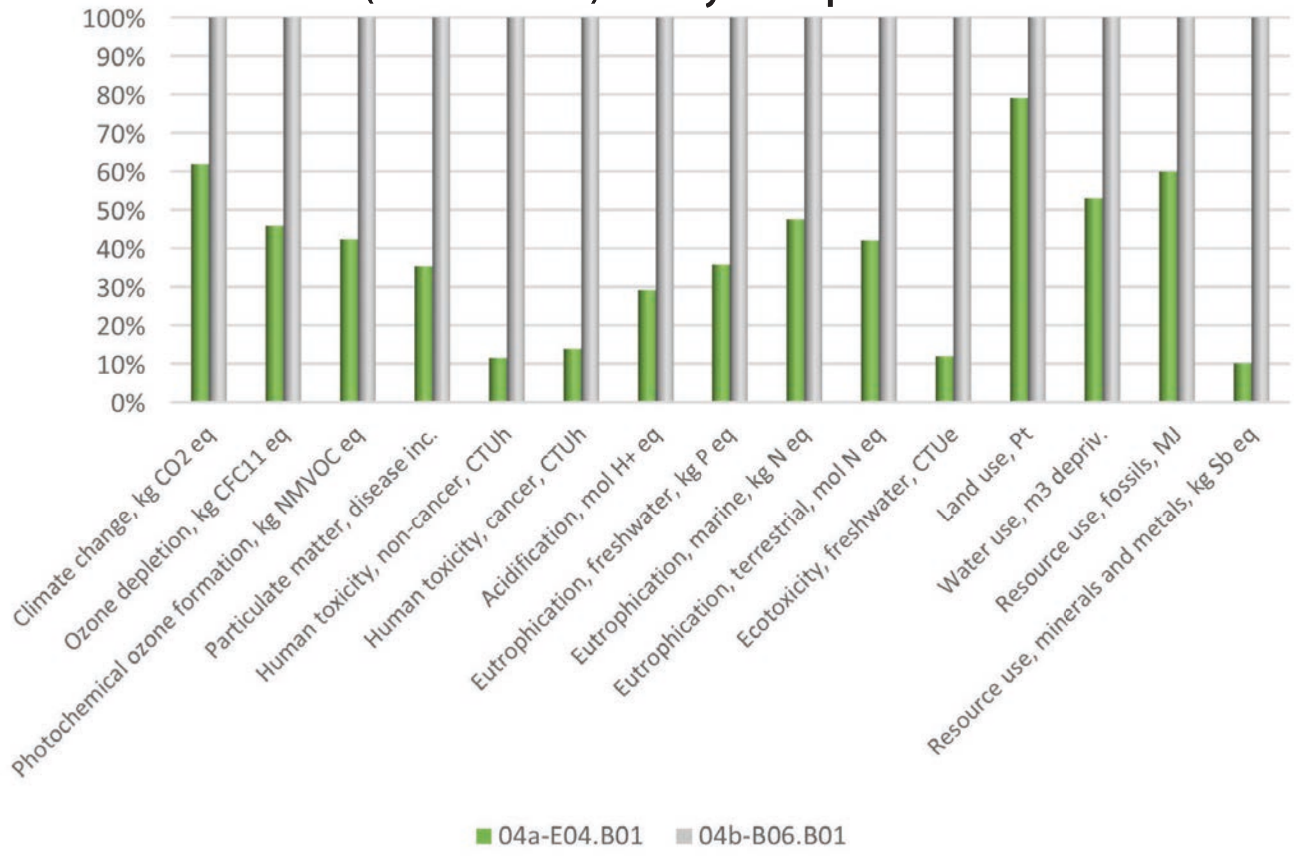
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.26 kg CO_2 eq.	**0.265** m^3
Freshwater Eutrophication	**Resource Depletion**
0.050 kg P eq.	**0.026** kg Sb eq.

timay & tempo Process Comparison:
E04.B01 versus B06.B01

Carbon Footprint	Total Water Consumption
-38%	-46%
Total Chemical Consumption	Total Energy Consumption
-44%	-29%

Process (Gate to Gate) Life Cycle Impact Reduction



E09.C00

Raw Material	Copper
Plating	Non Plated
Oxidation	Eco Oxidation
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

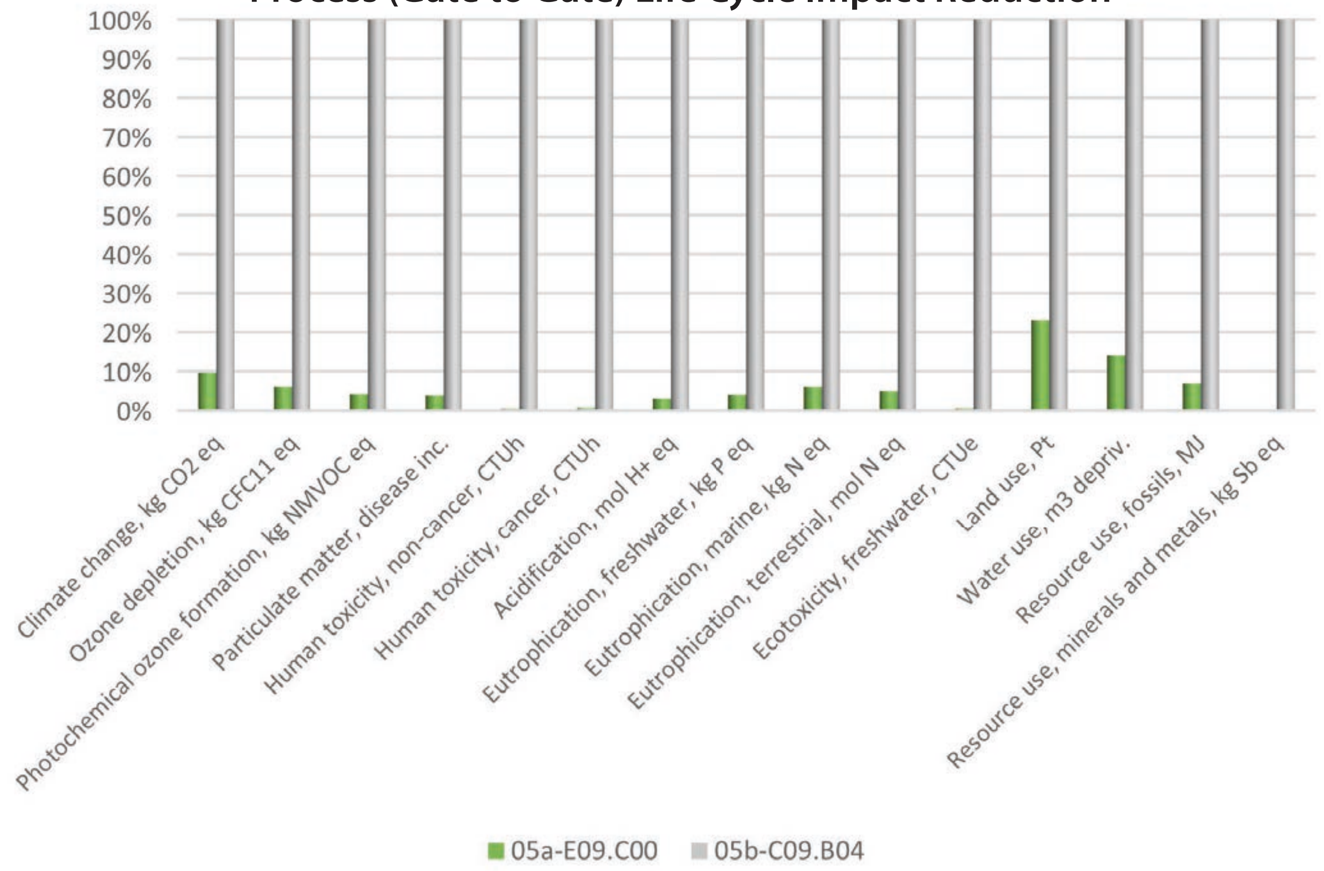
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.58 kg CO_2 eq.	**0.209** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
E09.C00 versus C09.B04

Carbon Footprint	Total Water Consumption
-90%	-76%
Total Chemical Consumption	Total Energy Consumption
-73%	-37%

Process (Gate to Gate) Life Cycle Impact Reduction



E09.C01

Raw Material	Copper
Plating	Non Plated
Oxidation	Eco Oxidation
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

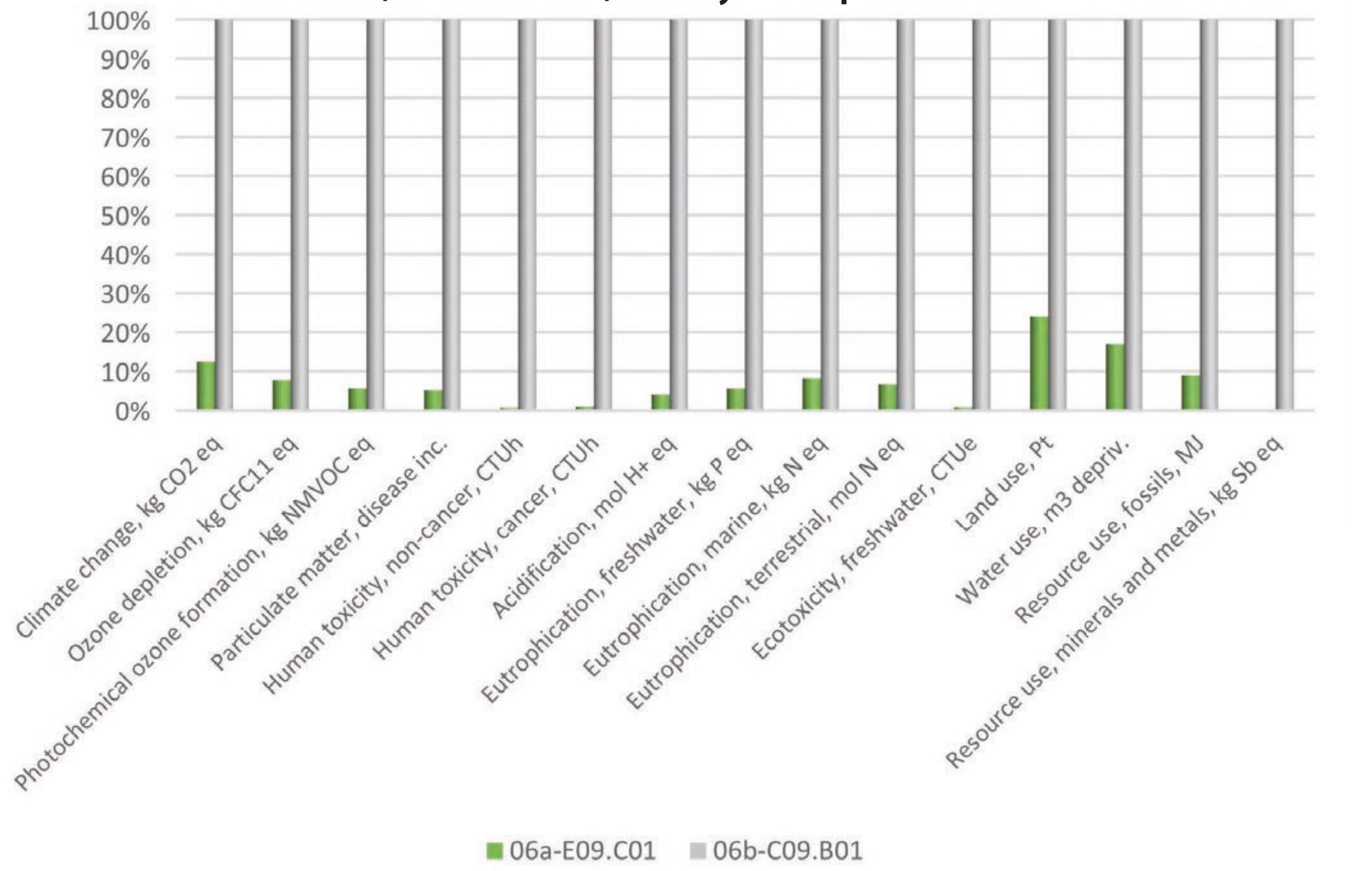
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
6.68 kg CO_2 eq.	**0.211** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
E09.C01 versus C09.B01

Carbon Footprint	Total Water Consumption
-88%	-74%
Total Chemical Consumption	Total Energy Consumption
-80%	-37%

Process (Gate to Gate) Life Cycle Impact Reduction



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E07.C02

Raw Material	Copper
Plating	Non Plated
Oxidation	Eco Oxidation
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

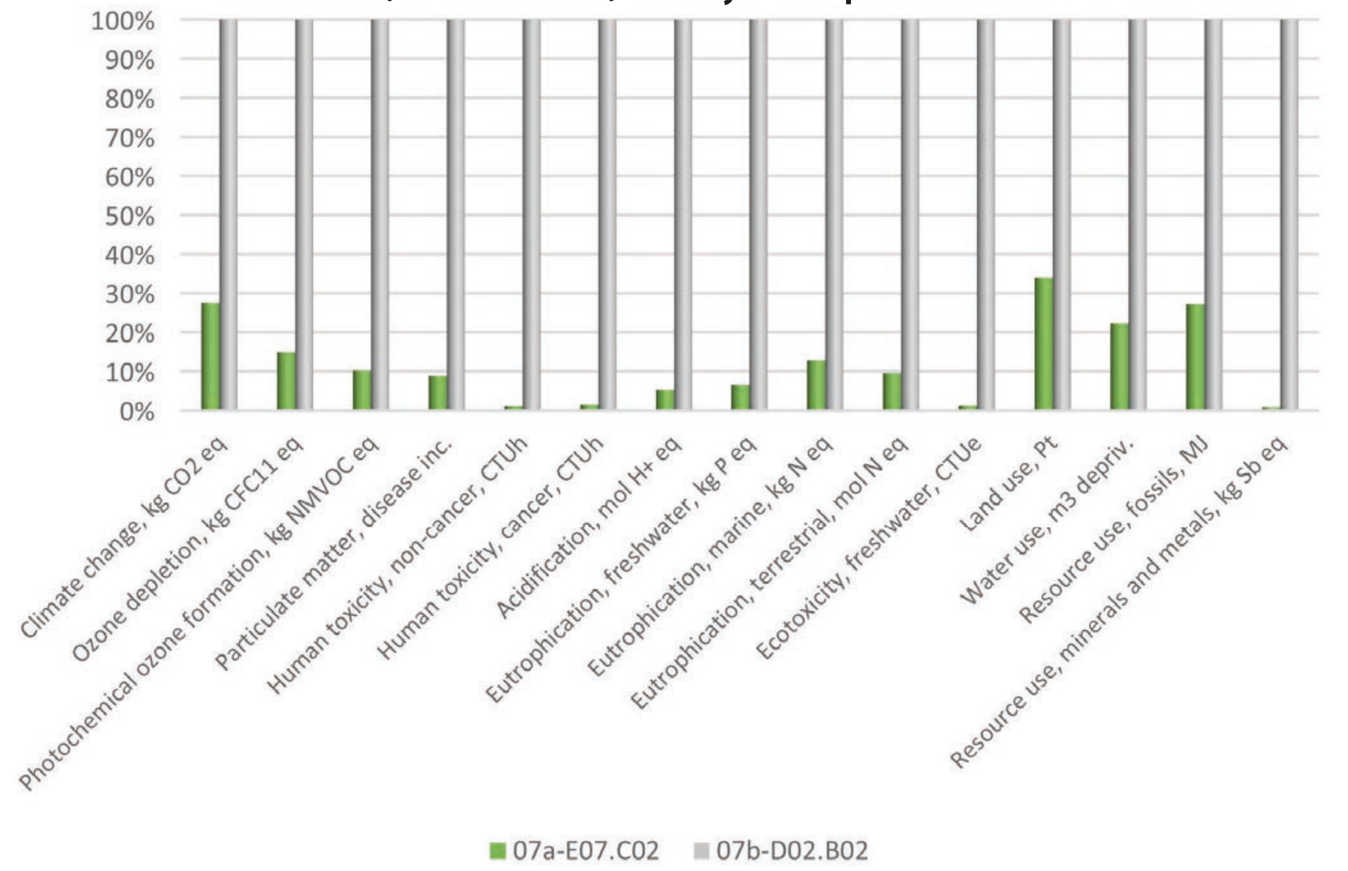
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.69 kg CO_2 eq.	**0.210** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
E07.C02 versus D02.B02

Carbon Footprint	Total Water Consumption
-73%	-81%
Total Chemical Consumption	Total Energy Consumption
-82%	-18%

Process (Gate to Gate) Life Cycle Impact Reduction



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E10.B00

Raw Material	Brass
Plating	Non Plated
Oxidation	Eco Oxidation
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

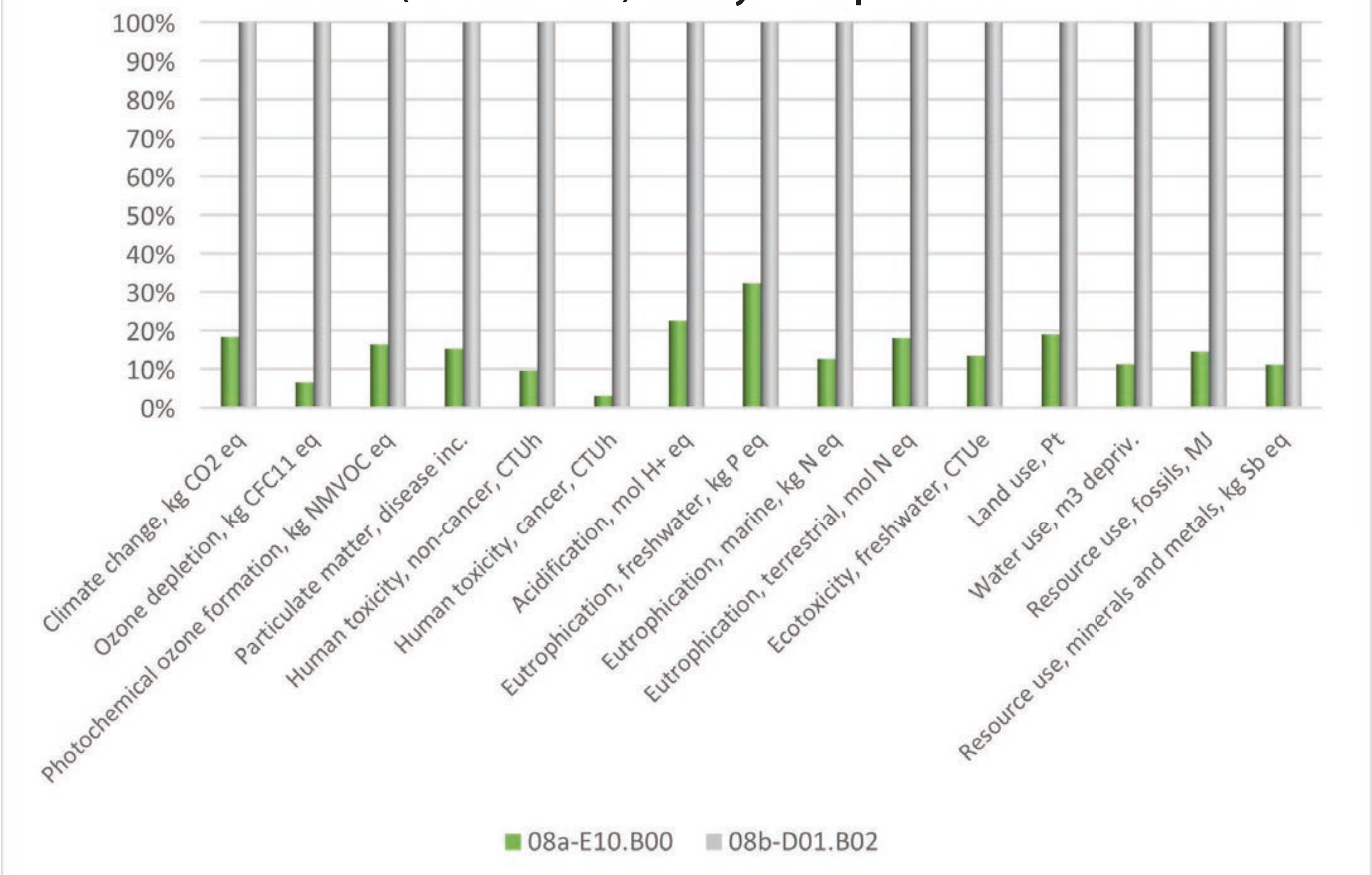
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.24 kg CO_2 eq.	**0.262** m^3
Freshwater Eutrophication	**Resource Depletion**
0.050 kg P eq.	**0.026** kg Sb eq.

timay & tempo Process Comparison:
E10.B00 versus D01.B02

Carbon Footprint	Total Water Consumption
-82%	-95%
Total Chemical Consumption	**Total Energy Consumption**
-65%	-5%

Process (Gate to Gate) Life Cycle Impact Reduction



E08.C00

Raw Material	Copper
Plating	Non Plated
Oxidation	Eco Oxidation
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

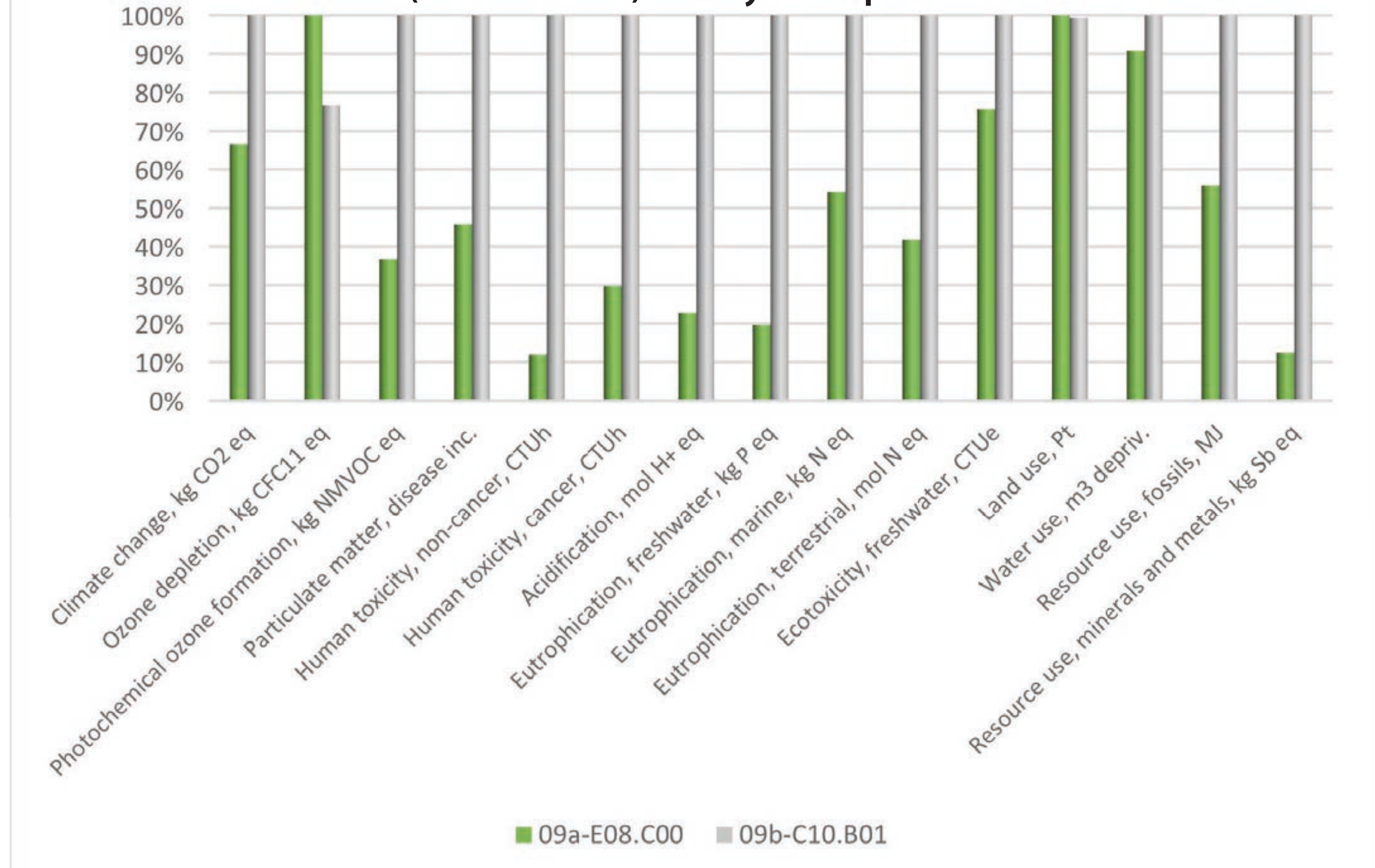
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
7.35 kg CO_2 eq.	**0.238** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
E08.C00 versus C10.B01

Carbon Footprint	Total Water Consumption
-33%	-62%
Total Chemical Consumption*	**Total Energy Consumption**
+889%	-13%

Process (Gate to Gate) Life Cycle Impact Reduction



** Product E08.C00 is prepared by 2 L European Oxide LQ, a dilute solution of approximately 14% sodium hydroxide and 20% sodium chloride. It's equivalent in the standard process only use 1 L solution with additional chemicals. Although the amount of solution is higher in the former, carbon footprint impacts are lower due to the low impact of the chemical content of the solution.*

R01.A06

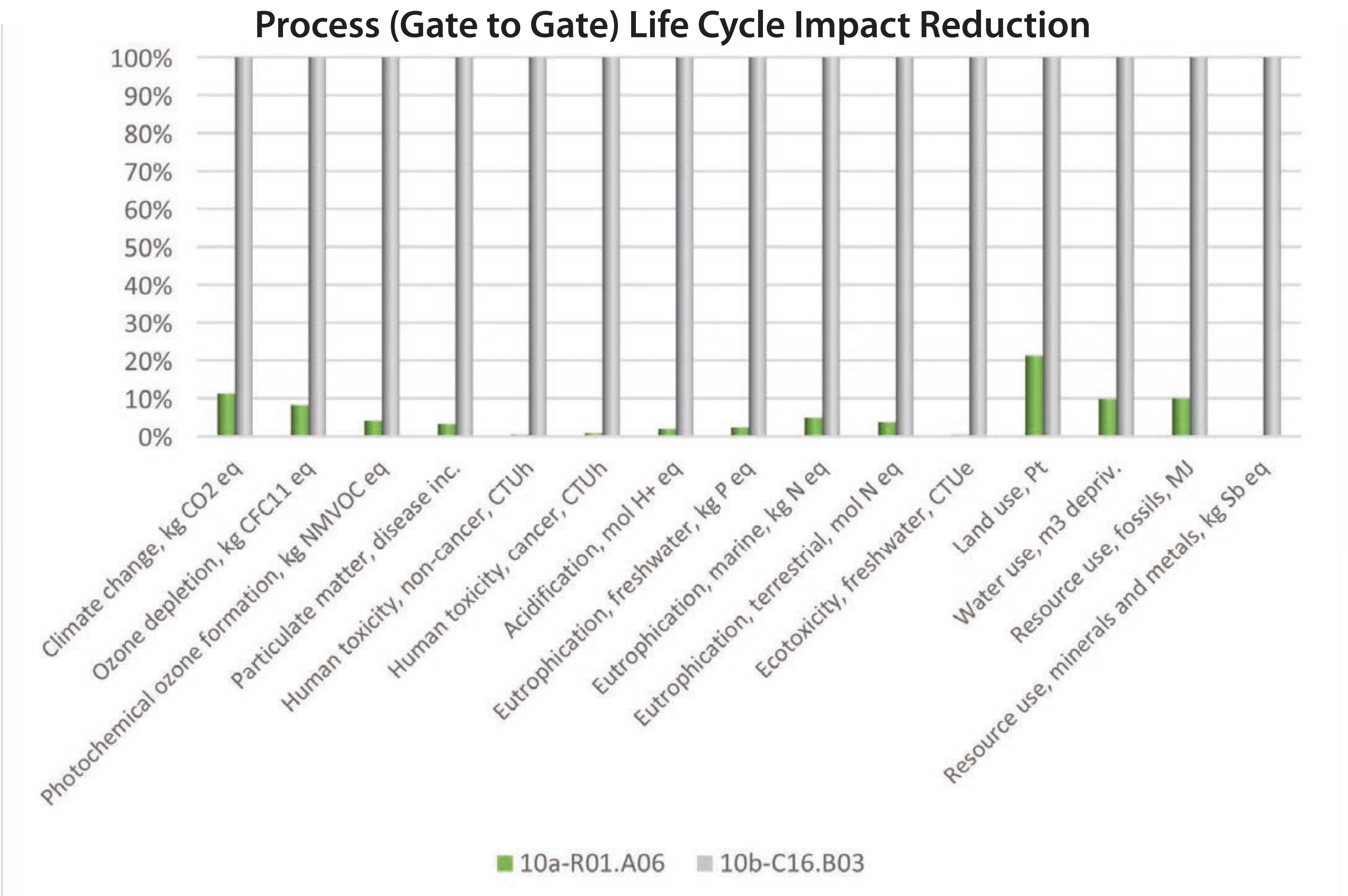
Raw Material	Aluminium
Plating	Non Plated
Oxidation	Non Oxidation (Only Rinse)
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint **10.9** **kg CO_2 eq.**	**Water Footprint** **0.058** **m^3**
Freshwater Eutrophication **0.005** **kg P eq.**	**Resource Depletion** **0.00004** **kg Sb eq.**

timay & tempo Process Comparison:
R01.A06 versus C16.B03

Carbon Footprint -89%	Total Water Consumption -89%
Total Chemical Consumption -85%	Total Energy Consumption -79%



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E01.S02

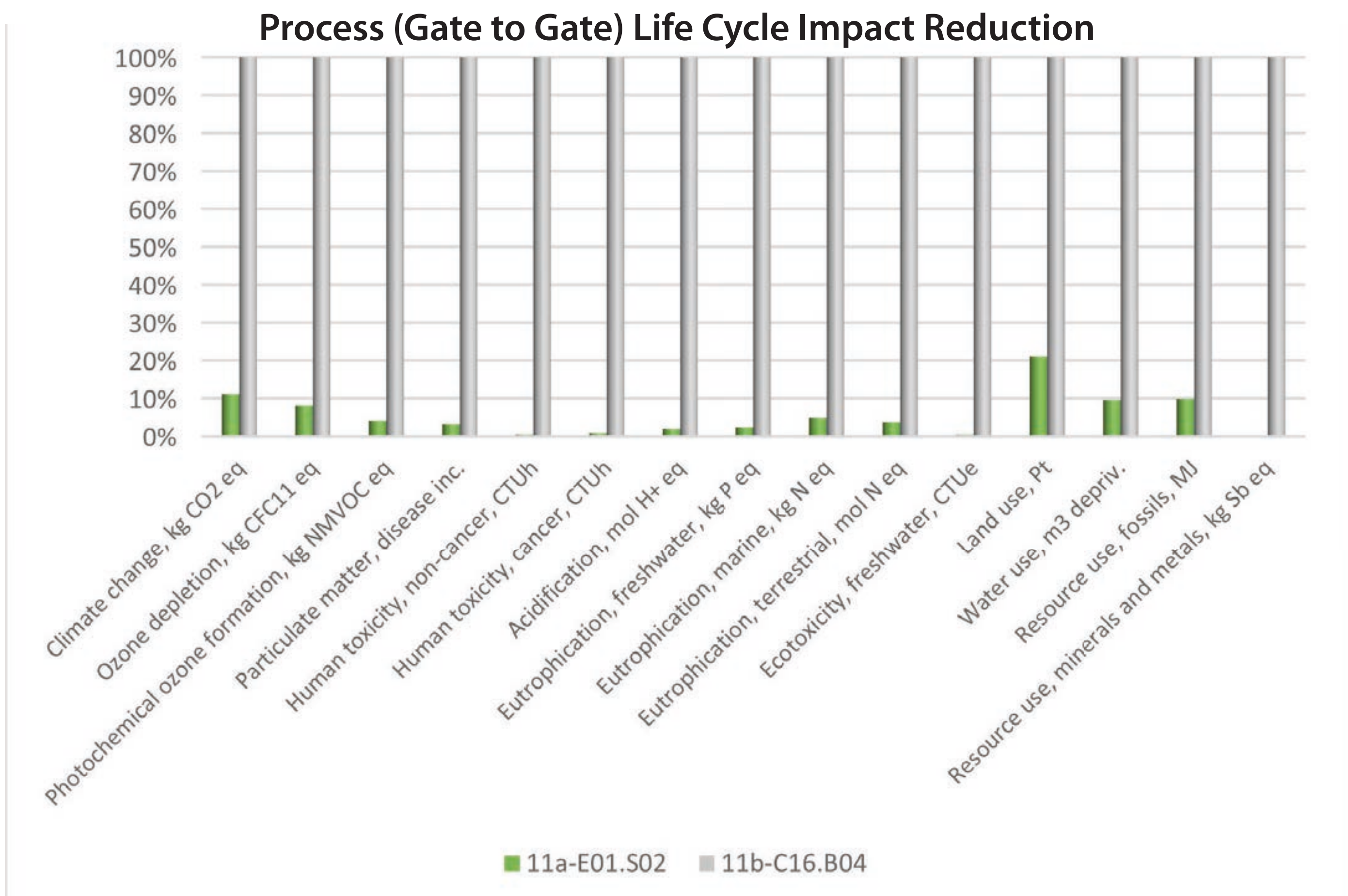
Raw Material	Stainless Steel
Plating	Non Plated
Oxidation	Non Oxidation (Only Rinse)
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint **5.44** **kg CO_2 eq.**	**Water Footprint** **0.059** **m^3**
Freshwater Eutrophication **0.002** **kg P eq.**	**Resource Depletion** **0.0001** **kg Sb eq.**

timay & tempo Process Comparison:
E01.S02 versus C16.B04

Carbon Footprint -89%	Total Water Consumption -89%
Total Chemical Consumption -86%	Total Energy Consumption -78%



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AK1.C00

Raw Material	Copper
Plating	Non Plated
Oxidation	Eco Oxidation
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

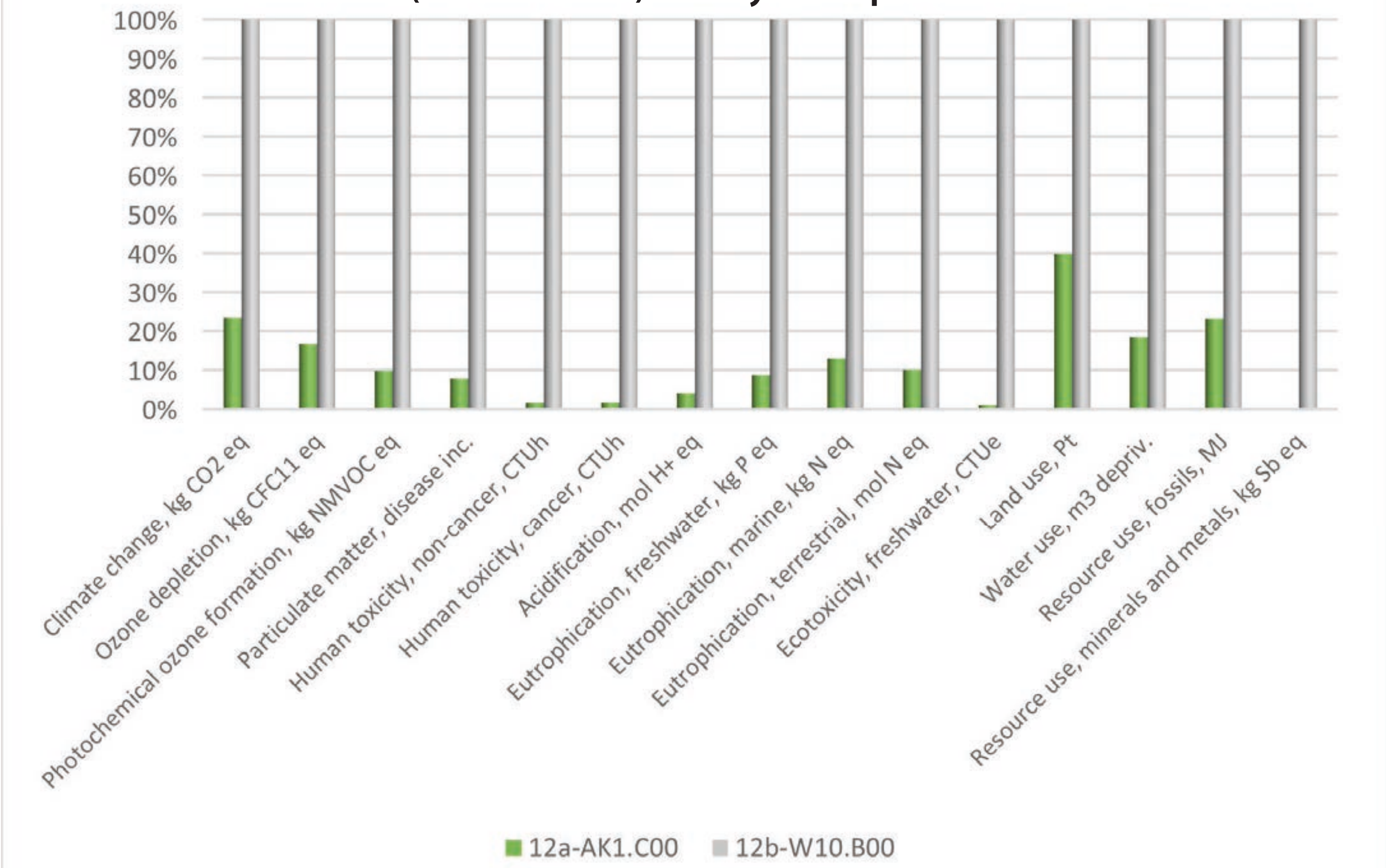
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.59 kg CO_2 eq.	**0.209** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
AK01.C00 versus W10.B00

Carbon Footprint	Total Water Consumption
-77%	-84%
Total Chemical Consumption	Total Energy Consumption
-86%	-49%

Process (Gate to Gate) Life Cycle Impact Reduction



E10.B01

Raw Material	Copper
Plating	Non Plated
Oxidation	Eco Oxidation
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

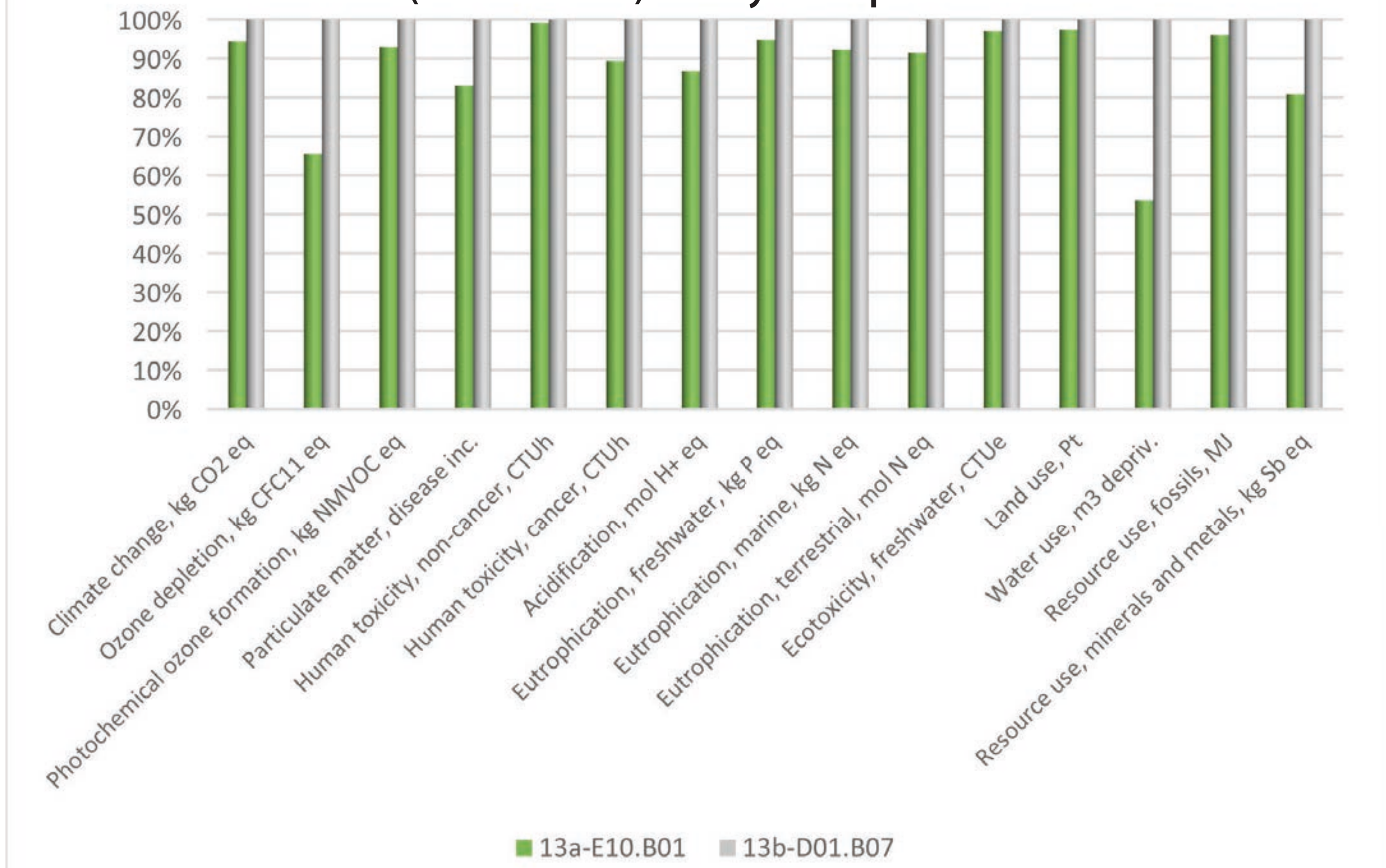
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.35 kg CO_2 eq.	**0.263** m^3
Freshwater Eutrophication	**Resource Depletion**
0.050 kg P eq.	**0.026** kg Sb eq.

timay & tempo Process Comparison:
E10.B01 versus D01.B07

Carbon Footprint	Total Water Consumption
-6%	-65%
Total Chemical Consumption	Total Energy Consumption
-28%	-4%

Process (Gate to Gate) Life Cycle Impact Reduction



E07.C03

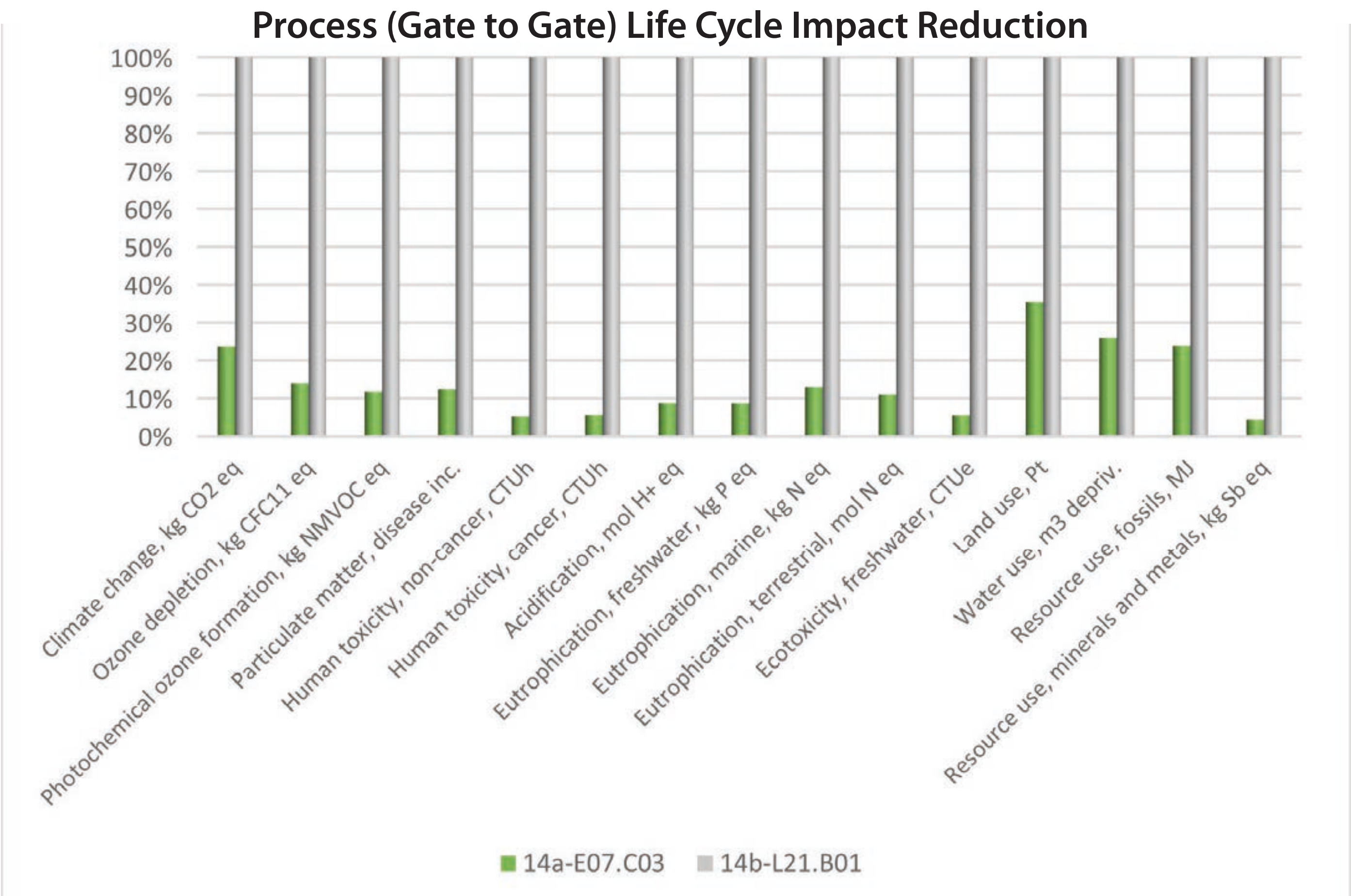
Raw Material	Copper
Plating	Non Plated
Oxidation	Eco Oxidation
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.61 kg CO_2 eq.	**0.211** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
E07.C03 versus L21.B01

Carbon Footprint	Total Water Consumption
-76%	-77%
Total Chemical Consumption	Total Energy Consumption
-64%	-50%



E01.C01 + White Water Based Paint

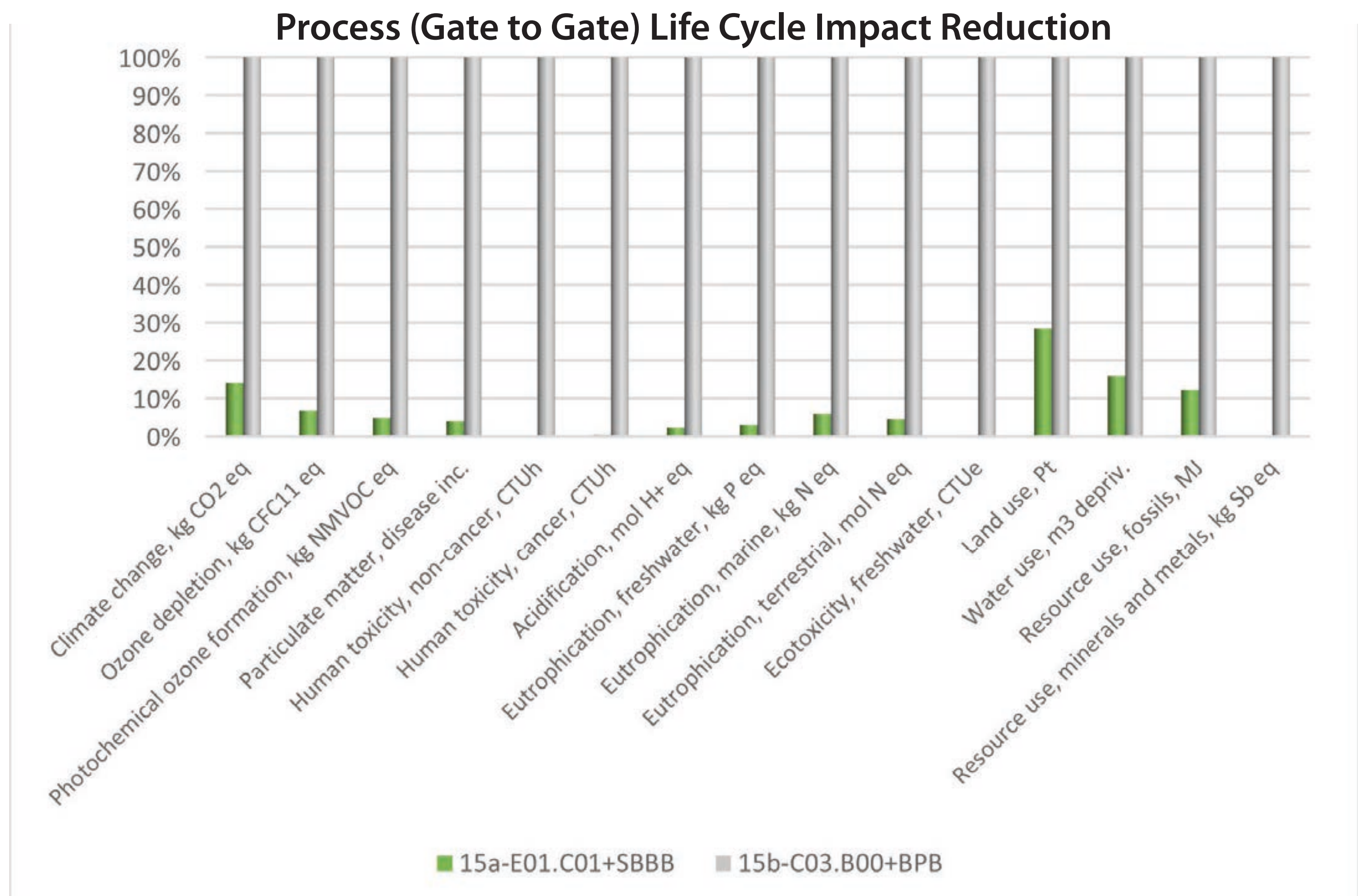
Raw Material	Copper
Plating	Non Plated
Oxidation	Non Oxidation
Paint- Lacquer	Water Based Paint
Body - (Underpart)	Non Plated Aluminium

Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.52 kg CO_2 eq.	**0.209** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
E01.C01 versus C03.B00

Carbon Footprint	Total Water Consumption
-86%	-73%
Total Chemical Consumption	Total Energy Consumption
-62%	-59%



E09.C00 + Black Water Based Paint

Raw Material	Copper
Plating	Non Plated
Oxidation	Non Oxidation (Only Rinse)
Paint- Lacquer	Water Based Paint
Body - (Underpart)	Non Plated Aluminium

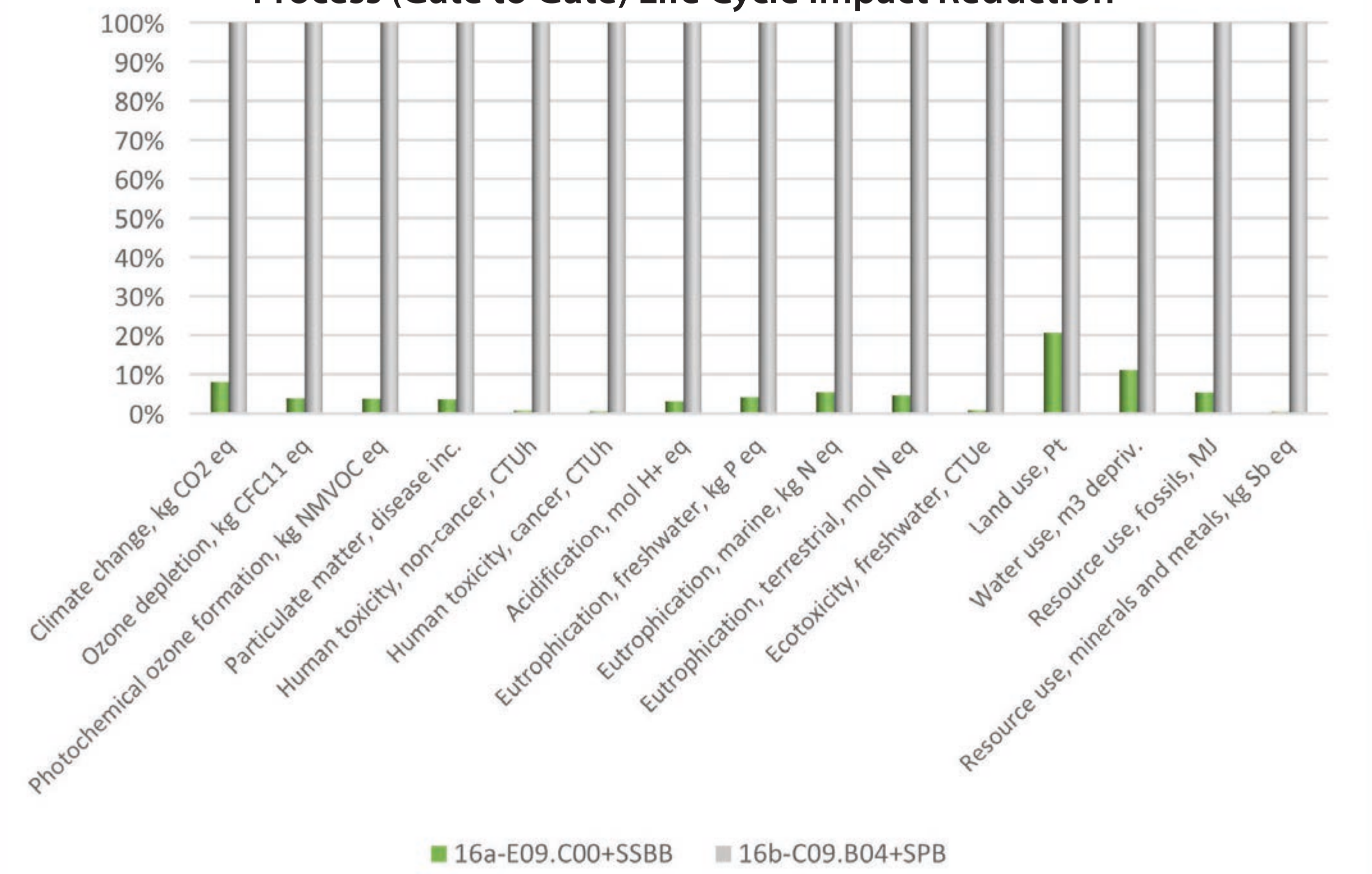
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.58 kg CO_2 eq.	**0.209** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
E09.C00 versus C09.B04

Carbon Footprint	Total Water Consumption
-92%	-76%
Total Chemical Consumption	Total Energy Consumption
-71%	-16%

Process (Gate to Gate) Life Cycle Impact Reduction



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E01.S01

Raw Material	Copper
Plating	Non Plated
Oxidation	Non Oxidation (Only Rinse)
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

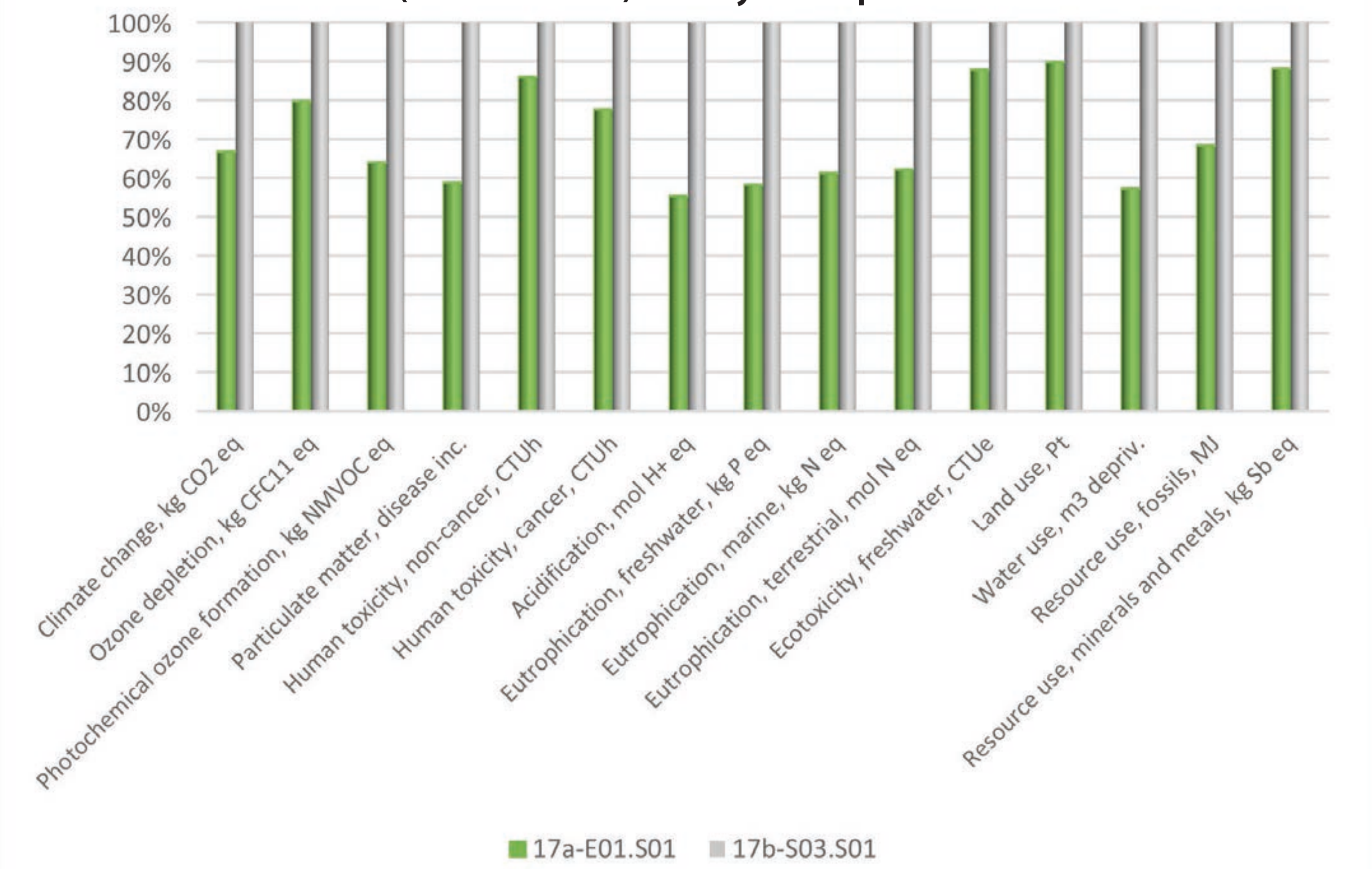
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.23 kg CO_2 eq.	**0.262** m^3
Freshwater Eutrophication	**Resource Depletion**
0.050 kg P eq.	**0.026** kg Sb eq.

timay & tempo Process Comparison:
E01.S01 versus S03.S01

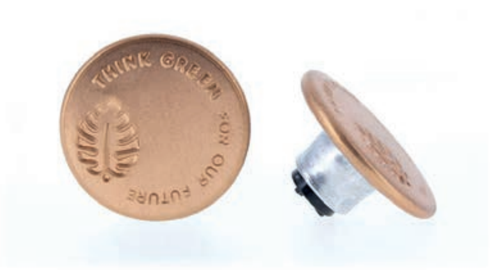
Carbon Footprint	Total Water Consumption
-33%	-50%
Total Chemical Consumption	Total Energy Consumption
-7%	-6%

Process (Gate to Gate) Life Cycle Impact Reduction



timay & tempo
SINCE 1987

C01.C00



Raw Material	Copper
Plating	Non Plated
Oxidation	Non Oxidation (Only Rinse)
Paint- Lacquer	Eco Lacquer
Body - (Underpart)	Non Plated Aluminium

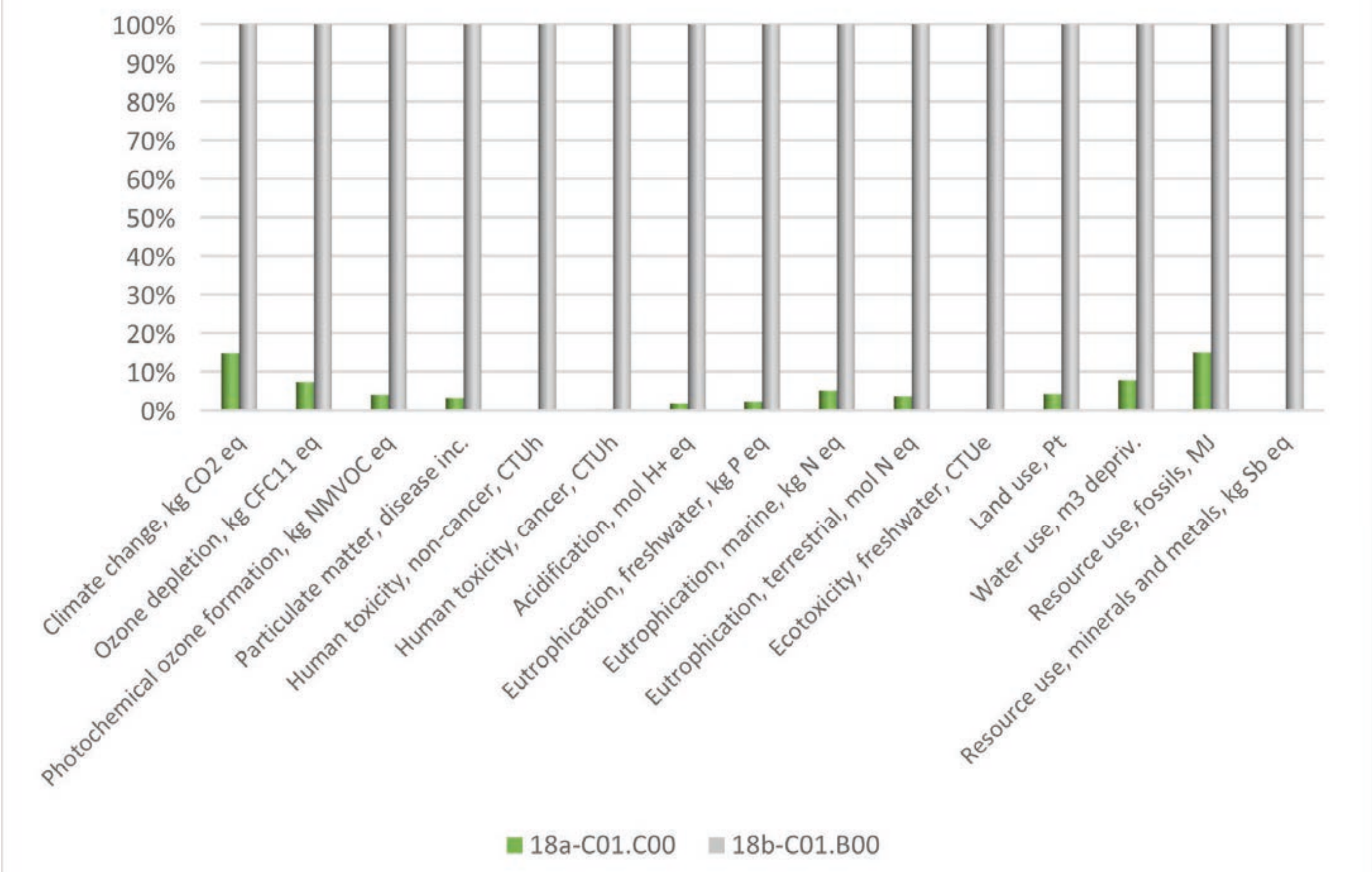
Whole Life Cycle Impact of 1 kg Final Product

Carbon Footprint	Water Footprint
5.46 kg CO_2 eq.	**0.206** m^3
Freshwater Eutrophication	**Resource Depletion**
0.068 kg P eq.	**0.003** kg Sb eq.

timay & tempo Process Comparison:
C01.C00 versus C01.B00

Carbon Footprint	Total Water Consumption
-85%	-100%
Total Chemical Consumption	Total Energy Consumption
-90%	-34%

Process (Gate to Gate) Life Cycle Impact Reduction



Additional Parameters

All inventory data such as energy, chemical, water consumptions and all environmental indicators such as carbon footprint, water footprint, eutrophication etc. are calculated with the product specific LCA models prepared using SimaPro LCA software (ver.9.1). Wastewater generation and wastewater treatment sludge generation, on the other hand, are allocated according to annual production figures.

timay & tempo has a wastewater treatment plant at its production site and treats its wastewater from production in accordance with the legal limits and regulations. Wastewater treatment sludge is disposed of by authorized waste management companies.

Generation of average wastewater and wastewater treatment sludge amounts are given below in Table per kg final product.

Parameter	Value kg/per kg product
Wastewater Generation	2.48
Wastewater Treatment Sludge	0.243

When shaping the buttons from metal strips, about 0.5 kg of metal scrap per kg of final product is generated. This scrap is very valuable and recycled via the metal recycling centres.

Evaluation

When all environmental impact parameters are assessed, the raw material stage is the dominant life cycle stage. According to EF Methodology, Global Warming Potential (GWP), for example, approximately 95% of the total carbon footprint in all products is resulted from raw materials, i.e. the metal strips used in the production of metal buttons for textiles. The remaining impacts come from the metal plating and related processes in production. Within the metal surface plating processes, intense use of electricity in sub-processes causes an increase in the impacts.

timay & tempo meets approximately 37% of its electricity need from the roof solar panels installed in the manufacturing facility and the rest comes from the Turkish electricity grid. The use of the renewable energy reduces the carbon impact as the grid electricity has high carbon impact. In Turkey, electricity in 2019 is generated approximately 67% from fossil resources, and the rest from renewable energy resources.

timay & tempo will continue to innovate to reduce environmental burden of its products and will share environmental impact of all our products transparently with our clients and wider society when such information is needed.

Glossary

Acidification

Acidification is an impact category expressing the toxic impact that acidizing substances create on the earth, underground water, upper ground water, organisms, ecosystems and the materials. Reaction of the acidic gases with the water in the atmosphere brings about the incident called 'acid rain'. And, the formation of the acid rains causes reduction of the variety in the ecosystem. The acidification in the Life Cycle Assessment is expressed in terms kg SO_2 equivalent.

Ecotoxicity Freshwater

Ecotoxicity is currently only represented by toxic effect on aquatic freshwater species in the water column. Impacts on other ecosystems, including sediments, are not reflected in current general practice. The characterization factor for aquatic ecotoxicity impacts (ecotoxicity potential) is expressed in comparative toxic units (CTUe).

Eutrophication

Eutrophication (also known as nutrification) includes all impacts due to excessive levels of macro-nutrients in the environment caused by emissions of nutrients to air, water and soil. With respect to terrestrial eutrophication, only the concentration of nitrogen is the limiting factor and hence important, therefore, original data sets include CFs for NH3, NO2 emitted to air. In freshwater environments, phosphorus is considered the limiting factor. Therefore, only P-compounds are provided for assessment of freshwater eutrophication. In marine water environments, nitrogen is the limiting factor, hence the method's inclusion of only N compounds in the characterization of marine eutrophication. The characterisation of impact of N-compound emitted into rivers that subsequently may reach the sea has to be further investigated.

Global Warming Potential (GWP)

Global warming is a concept expressing warming of the atmosphere due to climate change. One of the humanrelated activities causing global warming more than everything is combusting on the fossil resources such as petroleum, coal and natural gas. The global warming in the Life Cycle Assessment is expressed in terms kg CO_2 equivalent.

Human Ecoxicity, cancer & non- cancer

The characterization factor for human toxicity impacts (human toxicity potential) is expressed in comparative toxic units (CTUh), the estimated increase in morbidity in the total human population, per unit mass of a chemical emitted.

Ozone Layer Depletion

Ozone Layer Depletion is a concept expressing reduction of the ozone amount in stratosphere and depletion of the ozone layer called ozone hole by emission of human-related resources (CFC, HCFC, chlorine, bromine, etc.). Holing of the ozone layer is causing carcinogenic impact on the human being, animals and the plants. The ozone layer depletion in the Life Cycle Assessment is expressed in terms kg CFC-11 equivalent.

Particulate Matter

"Particulate matter," also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. The particulate matter,in the Life Cycle Assessment is expressed in terms disease inc..

Photochemical Oxidation

Photochemical oxidant formation (or photochemical smog) refers to a phenomenon that occurs under certain atmospheric conditions when pollutantforming emissions are present. It is particularly commonplace in relatively stagnant air when there is sunlight and low humidity, and in the presence of nitrogen oxides and volatile organic compounds (VOCs, excluding methane).

Resource Use, minerals and metals

For resources depletion at midpoint, the model recommended is the Abiotic Resource Depletion, "ultimate reserves" version, described in van Oers et al. (2002), based on the methods of Guinée et al. (2002). Resource Depletion is one of the impact categories expressing depletion of the natural resources (petroleum, iron ore, etc.) in the application of Life Cycle Assessment. It has global, regional and local aspects of impact and expresses the mineral amount used and the fossil fuel amount used. The resource depletion in the Life Cycle Assessment is expressed in terms kg Sb (Antimon) equivalent.

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