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LCA of Oatly Barista for Poland, Ireland and France, and comparison with cow's milk

Addendum to the report "LCA of Oatly Barista and comparison with cow's milk", published on 7 December 2022

Blonk CONSULTANTS

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Executive summary

Introduction

A Life Cycle Assessment (LCA) has been performed to compare the environmental performance of Oatly Barista to cow's milk in three sales markets in Europe: Poland, Ireland, and France. This study is an addendum to the report "LCA of Oatly Barista and comparison with cow's milk", which was published by Blonk Consultants on December 7th 2022 (Blonk Consultants, 2022) and covered Germany, the Netherlands, the United Kingdom, Sweden, Finland, and the United States. This addendum should be read in conjunction with the main report. The methodology, data choices, and assumptions made, are described in detail in the main report, and have remained unchanged for this report, except for an update of energy and water use in the Oatly factories.

The functional unit considered for this study is 1 liter of Oatly Barista/cow's milk at retail, including packaging manufacturing and packaging end of life. Both the ambient and chilled version were modelled for Oatly Barista. For cow's milk, a country-specific average market mix of skimmed, semi-skimmed, and whole milk was considered, as well as the most common heat treatment type (HTST or UHT) and packaging format (plastic, beverage carton, aseptic/chilled) in each country. The foreground data for Oatly Barista is based on company-specific data from Oatly and refers to production from Oatly's End-to-End (E2E) factory in Landskrona, Sweden, and Oatly's hybrid factory in Vlissingen, the Netherlands[1]. In this addendum, updated data (from 2022) has been used for the factories. For the cow's milk from Poland, Ireland and France, datasets from Agri-footprint 6.3 were used, which have been reviewed by the European Dairy Association.

Like the main report, this study has been performed and critically reviewed according to ISO 14040/14044/14071 standards for comparative assertions to be disclosed to the public and is in line with LCA guidelines including the European Product Environmental Footprint Category Rules (PEFCR). The analysis was done for key impact categories from the ReCiPe 2016 impact assessment method (including an uncharacterised land occupation indicator). The study was conducted between March and April 2024.

Results

Ambient Oatly Barista

As can be seen in Table 1 below, the ambient Oatly Barista for the three markets in scope has a lower impact than cow's milk for climate change (52% to 74% lower), fine particulate matter formation (77% to 85% lower), terrestrial acidification (31% to 80% lower), freshwater eutrophication (49% to 76% lower), marine eutrophication (66% to 72% lower), land use (11% to 70% lower), land occupation (30% to 71% lower), and water consumption (57% to 83% lower). For fossil resource scarcity, Oatly Barista has a 25% higher impact than cow's milk for the French market, and comparable to lower impact (7% to 52% lower) in the remaining markets. The relatively high fossil resource scarcity impact for Oatly Barista produced in the Vlissingen factory is related to the use of (fossil-based) thermal energy during processing. Cow's milk on the other hand, requires less heat for processing, and also has a lower distribution impact as it is produced locally. Oatly Barista has a higher impact than cow's milk for mineral resource scarcity (34% and 41% higher) for the Irish market. For the French and Polish market, the mineral resource scarcity has a comparable or lower impact (5% to 37% lower). Contributing factors to the mineral resource scarcity impact of Oatly Barista are the use of aluminum in the ambient beverage carton, as well as the use of renewable energy (minerals used for wind turbines) in the factories. Irish cow's milk has a relatively low impact for mineral resource scarcity due to the relatively high share of grass in the cows' diets (which requires relatively fewer inputs in terms of mineral fertilizers compared to compound feed), and due to its packaging (a plastic bottle).

[1] End-to-End (E2E) Factory: The entire production chain happens within Oatly's own factory. From grains to the finished product. Hybrid Factory: A Hybrid factory is an Oatly oatbase factory that pumps the oatbase through a pipe to a contract manufacturer next door. The contract manufacturer-neighbour fills and packs the products for Oatly.

TABLE 1 RELATIVE DIFFERENCES OF AMBIENT OATLY BARISTA COMPARED TO COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) OF PACKAGING. FOR EXAMPLE, -58% INDICATES THAT OATLY BARISTA HAS A 58% LOWER IMPACT COMPARED TO COW'S MILK. THE DIFFERENCES HAVE BEEN COLOR-CODED AS FOLLOWS: GREEN – MORE THAN 10% DIFFERENCE FAVORING OATLY BARISTA, YELLOW – THE DIFFERENCE IS 10% OR LOWER INDICATING SIMILAR PERFORMANCE FOR THE COMPARED PRODUCTS, RED – MORE THAN 10% DIFFERENCE FAVORING COW'S MILK. FOR OATLY BARISTA, THE PRIMARY OATLY PRODUCTION FACILITY IS LISTED FIRST, FOLLOWED BY THE SECONDARY OATLY PRODUCTION FACILITY. COW'S MILK REPRESENTS AN AVERAGE MILK PRODUCT AT RETAIL FOR EACH COUNTRY. ABBREVIATIONS USED: NL = THE NETHERLANDS AND SE = SWEDEN. FURTHER INFORMATION ON THE INDICATORS USED FOR THE IMPACT CATEGORIES CAN BE FOUND IN TABLE 5.

Country of sale	Impact category / Product	Climate change	Fine particulate matter	Terrestrial acidifi-cation	Freshwater eutrophi-cation	Marine eutrophi-cation	Land use	Land occupation	Mineral resource scarcity	Fossil resource scarcity	Water consum-ption
		kg CO2 eq	kg PM2.5 eq	kg SO2 eq	kg P eq	kg N eq	m2a crop eq	m2a	kg Cu eq	kg oil eq	m3
France Retail	Oatly Barista NL Factory	-52%	-77%	-68%	-49%	-66%	-40%	-52%	-5%	25%	-83%
Ireland Retail	Oatly Barista NL Factory	-56%	-79%	-40%	-51%	-71%	-11%	-30%	41%	-7%	-57%
	Oatly Barista SE Factory	-66%	-78%	-31%	-55%	-72%	-11%	-30%	34%	-43%	-65%
Poland retail	Oatly Barista NL Factory	-67%	-84%	-80%	-75%	-70%	-69%	-71%	-34%	-24%	-71%
	Oatly Barista SE Factory	-74%	-85%	-79%	-76%	-71%	-70%	-71%	-37%	-52%	-75%

Figure 1 shows the contribution of all life cycle stages to the climate change impact of Oatly Barista and cow's milk, showing that raw materials are the main contributor to the climate change impact of all products in scope. For Oatly Barista, the impact of the raw materials is mainly determined by oats and rapeseed oil, whereas for cow's milk, feed and cow's emissions (linked to enteric fermentation and manure management) are the main contributors.

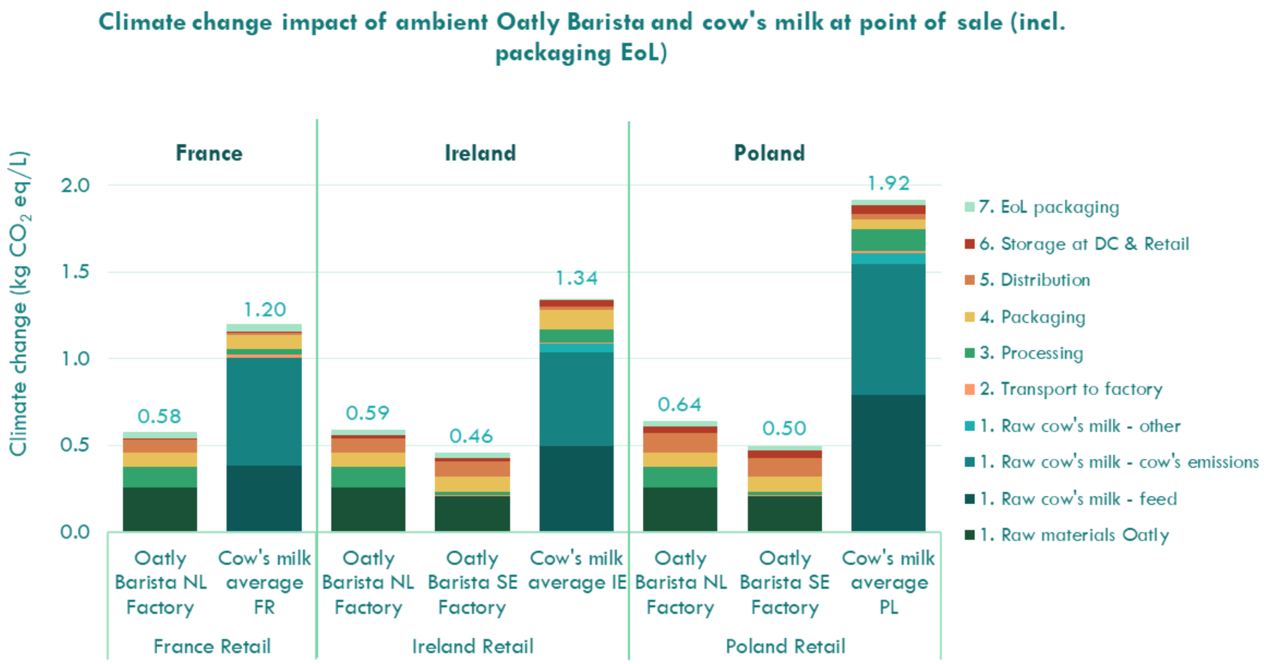

FIGURE 1 CLIMATE CHANGE IMPACT OF AMBIENT OATLY BARISTA AND COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) OF PACKAGING. IT INCLUDES OATLY BARISTA PRODUCED IN THE HYBRID FACTORY LOCATED IN VLISSINGEN, THE NETHERLANDS AND IN THE END-TO-END FACTORY IN LANDSKRONA, SWEDEN. THE PRIMARY PRODUCTION FACILITY IS LISTED FIRST, FOLLOWED BY THE SECONDARY PRODUCTION FACILITY (NOT APPLICABLE TO FRANCE). COW'S MILK REPRESENTS AN AVERAGE COW'S MILK PRODUCT AT RETAIL FOR EACH COUNTRY. ABBREVIATIONS USED: NL = THE NETHERLANDS, SE = SWEDEN, FR = FRANCE, IE = IRELAND, AND PL = POLAND

Chilled Oatly Barista

As can be seen in Table 2 below, the chilled Oatly Barista for the three markets in scope has a lower impact than cow's milk for climate change (49% to 71% lower), fine particulate matter formation (76% to 84% lower), terrestrial acidification (28% to 79% lower), freshwater eutrophication (51% to 74% lower), marine eutrophication (66% to 72% lower), land occupation (29% to 70% lower), and water consumption (56% to 83% lower). For land use (10% to 69% lower) the impact is lower, yet the difference is comparable for Oatly Barista from the Vlissingen factory distributed to the Irish market. For fossil resource scarcity, the chilled Oatly Barista has a 23% higher impact than cow's milk for the French market, a comparable impact (6% lower) for the Irish market when sourced from the Vlissingen factory, and a lower impact (22% to 49% lower) in the Polish market (sourced from both factories) and Irish market (sourced from the Landskrona factory). The chilled Oatly Barista has a higher impact than cow's milk for mineral resource scarcity (15% and 20% higher) for the Irish market. For the French and Polish market, Oatly Barista has a lower impact for mineral resource scarcity (23% to 48% lower).

TABLE 2 RELATIVE DIFFERENCES OF OATLY BARISTA CHILLED COMPARED TO COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) OF PACKAGING. FOR EXAMPLE, -58% INDICATES THAT OATLY BARISTA HAS A 58% LOWER IMPACT COMPARED TO COW'S MILK. THE DIFFERENCES HAVE BEEN COLOR-CODED AS FOLLOWS: GREEN – MORE THAN 10% DIFFERENCE FAVORING OATLY BARISTA, YELLOW – THE DIFFERENCE IS 10% OR LOWER INDICATING SIMILAR PERFORMANCE FOR THE COMPARED PRODUCTS, RED – MORE THAN 10% DIFFERENCE FAVORING COW'S MILK. FOR OATLY BARISTA, THE PRIMARY OATLY PRODUCTION FACILITY IS LISTED FIRST, FOLLOWED BY THE SECONDARY OATLY PRODUCTION FACILITY. COW'S MILK REPRESENTS AN AVERAGE MILK PRODUCT AT RETAIL FOR EACH COUNTRY. ABBREVIATIONS USED: NL = THE NETHERLANDS AND SE = SWEDEN. FURTHER INFORMATION ON THE INDICATORS USED FOR THE IMPACT CATEGORIES CAN BE FOUND IN TABLE 5.

Country of sale	Impact category / Product	Climate change	Fine particulate matter	Terrestrial acidifi-cation	Freshwater eutrophi-cation	Marine eutrophi-cation	Land use	Land occupation	Mineral resource scarcity	Fossil resource scarcity	Water consum-ption
		kg CO2 eq	kg PM2.5 eq	kg SO2 eq	kg P eq	kg N eq	m2a crop eq	m2a	kg Cu eq	kg oil eq	m3
France Retail	Oatly Barista NL Factory	-49%	-77%	-68%	-51%	-66%	-39%	-52%	-23%	23%	-83%
Ireland Retail	Oatly Barista NL Factory	-53%	-78%	-38%	-52%	-71%	-10%	-29%	20%	-6%	-56%
	Oatly Barista SE Factory	-63%	-76%	-28%	-56%	-72%	-11%	-30%	15%	-39%	-64%
Poland retail	Oatly Barista SE Factory	-71%	-84%	-78%	-74%	-71%	-69%	-70%	-48%	-49%	-73%
	Oatly Barista NL Factory	-64%	-84%	-79%	-74%	-70%	-69%	-70%	-46%	-22%	-69%

Figure 2 on the next page shows the contribution of all life cycle stages to the climate change impact of Oatly Barista and cow's milk, showing similar trends as explained for Figure 1.

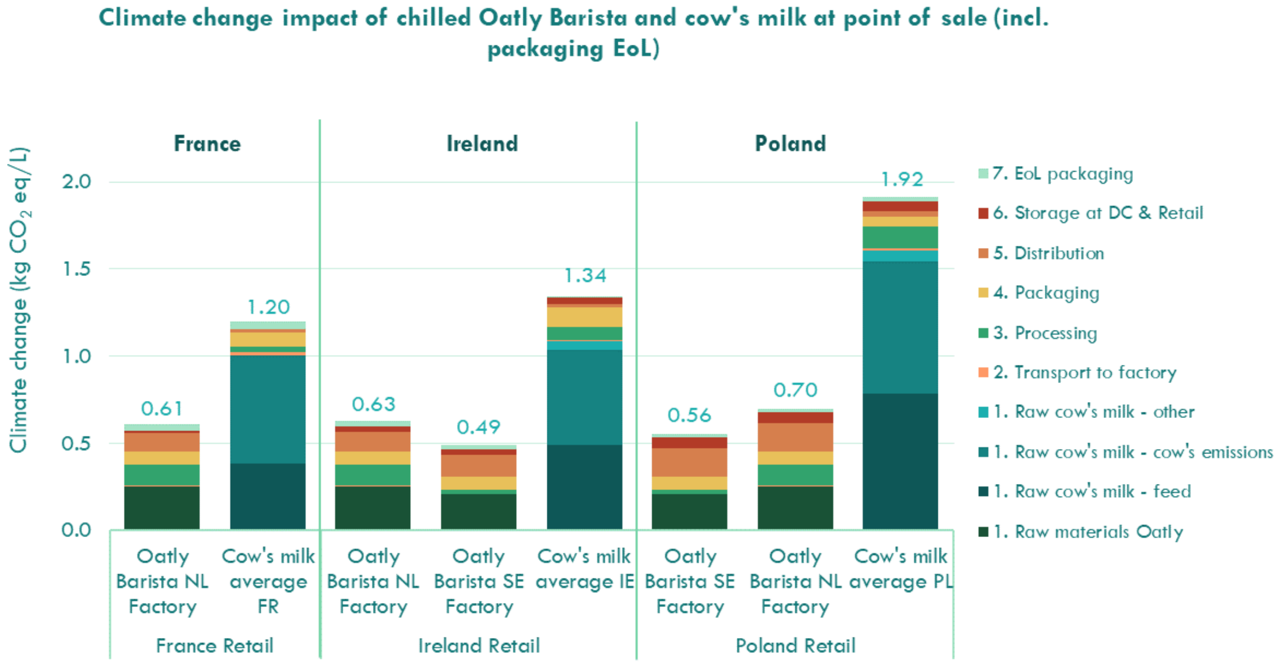

FIGURE 2 CLIMATE CHANGE IMPACT OF CHILLED OATLY BARISTA AND COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) OF PACKAGING. IT INCLUDES OATLY BARISTA PRODUCED IN THE HYBRID FACTORY LOCATED IN VLISSINGEN, THE NETHERLANDS AND IN THE END-TO-END FACTORY IN LANDSKRONA, SWEDEN. THE PRIMARY PRODUCTION FACILITY IS LISTED FIRST, FOLLOWED BY THE SECONDARY PRODUCTION FACILITY (NOT APPLICABLE TO FRANCE). COW'S MILK REPRESENTS AN AVERAGE COW'S MILK PRODUCT AT RETAIL FOR EACH COUNTRY. ABBREVIATIONS USED: NL = THE NETHERLANDS, SE = SWEDEN, FR = FRANCE, IE = IRELAND, AND PL = POLAND

The significance of the differences between Oatly Barista and cow's milk has been determined by an uncertainty analysis.[2]

The main report included further sensitivity analyses, which also apply to the products evaluated in this addendum, as the products in this addendum are very similar and show a comparable (on average relatively lower) impact than Oatly Barista in the main report. These sensitivity analyses pointed out that using a different impact assessment method (ReCiPe endpoint, EF3.0 single score) confirmed the overall higher environmental footprint of cow's milk compared to Oatly Barista for all countries in scope. It also showed that results in the impact categories land use, mineral resource scarcity and water impact categories are less robust, as they result in different trends when using a different impact assessment method (EF 3.0). Furthermore, the sensitivity analyses in the main report concluded that using different product characteristics (inclusion of use stage, using economic allocation for cow's milk, a functional unit based on nutritional characteristics), did not lead to different conclusions on the environmental footprint of Oatly Barista compared to cow's milk.

[2] It should be noted that the use of yellow colours in Table 1 and Table 2, which indicates comparable results, mostly (though not always) corresponds to insignificant differences as pointed out by the uncertainty analysis. The results of the uncertainty analysis can be found in section 5.2.

Conclusions

Based on the results, the following conclusions can be drawn for Oatly Barista and Oaty Ambient and chilled:

Ambient Oatly Barista:

- Oatly Barista has a lower impact than cow's milk for the impact categories climate change, fine particulate matter formation, terrestrial acidification, freshwater eutrophication, marine eutrophication, land use, land occupation, and water consumption.
- For mineral resource scarcity, Oatly Barista has a higher impact than cow's milk for the Irish market, whereas the impact is comparable for the Polish market and lower for the French market.
- For fossil resource scarcity, Oatly Barista has a higher impact than cow's milk for the French market, whereas the impact is lower for the Polish market. For the Irish market, the fossil resource scarcity impact is lower when sourced from the Landskrona factory, and comparable when sourced from the Vlissingen factory.

Chilled Oatly Barista:

- Oatly Barista has a lower impact than cow's milk for the impact categories climate change, fine particulate matter formation, terrestrial acidification, freshwater eutrophication, marine eutrophication, land occupation, and water consumption.
- Oatly Barista has a lower impact than cow's milk for land use, though the difference is comparable to cow's milk for Oatly Barista from the Vlissingen factory distributed to the Irish market.
- For mineral resource scarcity, Oatly Barista has a higher impact than cow's milk for the Irish market, whereas the impact is lower for the Polish and French market.
- For fossil resource scarcity, Oatly Barista has a higher impact than cow's milk for the French market, whereas the impact is lower for the Polish market. For the Irish market, the fossil resource scarcity impact is lower when sourced from the Landskrona factory, and comparable when sourced from the Vlissingen factory.

Overall, the analysis of Oatly Barista and its comparison to cow's milk in the markets assessed lead to similar conclusions as in the main report.

A detailed analysis of the main drivers and opportunities linked to the environmental impact of Oatly products can be found in the main report.

1. Goal & Scope

1.1 Introduction

This report is an addendum to the report "LCA of Oatly Barista and comparison with cow's milk", which was published by Blonk Consultants on December 7th 2022 (Blonk Consultants, 2022)[3] and will from now on be referred to in this addendum as "the main report". This addendum investigates 3 further products from Oatly: Oatly Barista sold in Poland, Ireland, and France. Like the Oatly Barista that was modelled for European countries in the main report, they are produced at the Vlissingen and Landskrona factories. The exact products and markets in scope are listed in Table 3 below. In line with the main report, these products are compared to cow's milk produced in the country of sale. The packaging size is identical to the main report (1 liter beverage carton) for all products.

The methodology, data choices, and assumptions made, are described in detail in the main report, and have remained unchanged for this report. The following has been updated in this report:

- The energy and water use at the Vlissingen and Landskrona factories has been updated to 2022 data.
- Background data have been updated to the following database versions: Agri-footprint 3.6, and Ecoinvent 3.9.
- Country-specific distribution data from the Vlissingen and Landskrona factories to Poland, Ireland and France, for both ambient and chilled versions of Barista.

Like the main report, this addendum has been subject to a critical review according to ISO 14040/14044 and ISO/TS 14071:2014 standards (ISO, 2006b, 2006a, 2014), carried out by a review panel consisting of four LCA experts (three of which had already reviewed the main report). The review of the addendum focused particularly on elements that were added or changed compared to the main report and assessed the overall conformance with ISO 14040/14044 standards.

This addendum is not a stand-alone report and should be read in conjunction with the main report. It should be noted that the climate change impact results from this study do not always correspond with those mentioned on Oatly's packaging/web page as the latter are calculated by a different LCA provider that uses different background data and/or different system boundaries.

1.2 Goal and scope

1.2.1 Goal

The goal of this study is in line with the goal mentioned in section 1.2 of the main report: to assess the environmental impacts of a selection of Oatly Barista products, and compare them to cow's milk in their respective markets. Further details on the intended use of this study can be found in section 1.2 of the main report.

1.2.2 Scope

The function based on which the two systems are compared is defined as follows: the provision of cow's milk or oat-based drinks, to be added to food and beverage items for taste and texture, provided in 1 liter packaging at point of sale.

The functional units associated with both systems are:

- Oat drink: 1 liter of Oatly Barista (chilled or ambient), including packaging, at retail.

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[3] Link to the publication: https://website-production-s3bucket-1nevfd7531z8u.s3.eu-west-1.amazonaws.com/public/website/download/fabc1628-d8e1-4cf8-aacc-1a9694908a42/LCA%20Oatly%20and%20comparison%20to%20cow's%20milk%20(07-12-2022)%20-%20final.pdf

- Cow's milk: 1 liter of HTST (high temperature short time pasteurization) or UHT (ultra-high temperature pasteurization) whole, and (semi-)skimmed cow's milk (using a country-average mix of these three milk types), including packaging, at retail (chilled or ambient storage)

Table 3 list the reference flows related to the Oatly products in scope, as well as for their cow's milk equivalents. Since the Oatly Barista available in Poland and Ireland is sourced from both the Vlissingen and Landskrona factories, both production locations are considered. The Oatly Barista available in France is sourced solely from the Vlissingen factory.

The system boundaries considered for this addendum are from cradle-to-point of sale (including packaging end-of-life), in line with the main report. More details on the system boundaries can be found in section 1.3.2 from the main report.

Nutritional properties of Oatly Barista and cow's milk can be found in Appendix V.

TABLE 3: REFERENCE FLOWS OF THE OATLY BARISTA PRODUCTS AND COW'S MILK

Oatly Barista				…Compared with cow's milk				Sold in
Reference flow	Local name	Storage condition	Produced in	Reference flow	Storage condition	Cow's milk type	Produced in	Country
Ambient								
1 liter	Oatly Boisson à l'avoine Barista Edition	Ambient	Vlissingen, the Netherlands	1 liter	Ambient	Mix of UHT-treated whole and (semi-) skimmed milk (beverage carton)	France	France
1 liter	Oatly Oat Drink Barista Edition	Ambient	Vlissingen, the Netherlands	1 liter	Chilled	Mix of HTST-treated whole and (semi-) skimmed milk (plastic bottle)	Ireland	Ireland
1 liter	Oatly Oat Drink Barista Edition	Ambient	Landskrona, Sweden	1 liter	Chilled	Mix of HTST-treated whole and (semi-) skimmed milk (plastic bottle)	Ireland	Ireland
1 liter	Oatly Napój Owsiany Barista Edition	Ambient	Vlissingen, the Netherlands	1 liter	Chilled	Mix of HTST-treated whole and (semi-) skimmed milk (beverage carton)	Poland	Poland
1 liter	Oatly Napój Owsiany Barista Edition	Ambient	Landskrona, Sweden	1 liter	Chilled	Mix of HTST-treated whole and (semi-) skimmed milk (beverage carton)	Poland	Poland
Chilled								
1 liter	Oatly Boisson à l'avoine Barista Edition	Chilled	Vlissingen, the Netherlands	1 liter	Ambient	Mix of UHT-treated whole and (semi-) skimmed milk (beverage carton)	France	France
1 liter	Oatly Oat Drink Barista Edition	Chilled	Vlissingen, the Netherlands	1 liter	Chilled	Mix of HTST-treated whole and (semi-) skimmed milk (plastic bottle)	Ireland	Ireland
1 liter	Oatly Oat Drink Barista Edition	Chilled	Landskrona, Sweden	1 liter	Chilled	Mix of HTST-treated whole and (semi-) skimmed milk (plastic bottle)	Ireland	Ireland
1 liter	Oatly Napój Owsiany Barista Edition	Chilled	Landskrona, Sweden	1 liter	Chilled	Mix of HTST-treated whole and (semi-) skimmed milk (beverage carton)	Poland	Poland
1 liter	Oatly Napój Owsiany Barista Edition	Chilled	Vlissingen, the Netherlands	1 liter	Chilled	Mix of HTST-treated whole and (semi-) skimmed milk (beverage)	Poland	Poland

Oatly Barista

Oatly Barista is an oat-based drink that is fortified with calcium, vitamin D, riboflavin, vitamin B12, and iodine. Next to that, oil is added as a functional ingredient that provides structure and texture to the drink. "Barista" refers to the oat drink's functionality in coffee, for which Oatly Barista's foamability and stability are leading properties. Oatly Barista is known under different market names in the countries in scope (as mentioned in Table 3), but in the remainder of this report, it is consistently referred to as "Oatly Barista" for all countries.

Oatly Barista also has a "chilled" version which entails different production and storage requirements. More specifically, it uses a different packaging concept which does not contain aluminum and it is transported and stored chilled. The factory process is identical for chilled and ambient products, yet the ambient version is cooled down to 25 degrees Celsius whilst the chilled product requires cooling to about 5 degrees Celsius. The energy demand for this additional step is estimated to be very small compared to the overall process, so the average energy consumption was used for both versions. It should be noted that the chilled version of Oatly Barista is not yet available in all sales markets, but has been added since all required data were present.

Cow's milk

Since the Oatly products in this study can replace skimmed, semi-skimmed and whole cow's milk, the country-average mix of (semi-)skimmed and whole cow's milk has been selected for the comparison. Table 4 describes which data have been used to define this country-average mix of cow's milk, and section 1.3 of the main report provides further background information.

TABLE 4 MARKET MIX FOR COW'S MILK IN TERMS OF FAT CONTENT, HEAT TREATMENT TYPE, AND PACKAGING TYPE

	France	Ireland	Poland	*Comments*
Fat content	(European Commission, 2018)	(Safefood, 2008)	(IERiGZ, 2005)	Since the sources for Poland and Ireland didn't provide a distinction between skimmed and semi-skimmed milk, the share of both was assumed to be 50%.
Skimmed	6%	13.5%	23%	
Semi-skimmed	85%	13.5%	23%	
Whole milk	9%	73%	53%	
Thermal treatment	(European Commission, 2018)	(Rysstad & Kolstad, 2006)	(Rysstad & Kolstad, 2006)	
HTST		x	x	
UHT	x			
Packaging	(European Commission, 2018)	(IFEU, 2022)	(European Commission, 2018)	For Poland, the category "Other EU" was used from table IV-1 in the Dairy PEFCR. For Ireland, same packaging was assumed as for UK given the similarity of markets as described in IFEU (2022)
Multilayer carton 1L - HTST			x	
Multilayer carton 1L - UHT	x			
Plastic bottle 1L		x		

1.2.3 Critical review

A critical review is carried out according to ISO 14040/14044 and ISO/TS 14071:2014 standards (ISO, 2014), in order to assess whether this study is consistent with LCA principles and meets all criteria related to methodology, data, interpretation and reporting. Because of the comparative nature of this LCA, the review is conducted by a panel.

A review panel of four independent and qualified external experts has been compiled, reflecting a balanced combination of qualifications (LCA, dairy, sustainable food systems) and backgrounds.

- Jasmina Burek (chair): Assistant Professor at University of Massachusetts Lowell (based in the US)
- Joseph Poore: Food Sustainability expert at the University of Oxford (based in the UK)
- Jens Lansche: LCA expert (based in Switzerland)
- Hayo van der Werf: LCA expert (based in France)

Since a review panel (with 3 out of 4 of the above reviewers) had already reviewed the main report, and have verified the methodology, data and assumptions made there, for this addendum only one review round was needed. The full review statement and report can be found in Appendix VI of the main report. This addendum includes a shortened review statement applying specifically to this addendum.

The critical review statement and report can be found in Appendix VI.

2. Calculation method

This addendum follows the exact same methodological standards and approaches as listed in chapter 2 of the main report. One small change is that the land occupation indicator is now included as additional impact category (instead of only in the appendix). In the ReCiPe impact assessment method, land use is expressed as intensity of the land use relative to annual crops (see M. A. J. Huijbregts, Steinmann, Elshout, & Stam, 2016) for more information), and hence the unit used is m^2a crop-eq. Due to several flaws related to the methodology of this indicator,[4] the land occupation indicator was added, which shows land occupation results without characterization, with the unit m^2a, and thus reflects the surface area needed to produce the products in scope. Table 5 provides an overview of the impact categories used in this study, including a description of the indicators and characterisation factors belonging to these categories.

TABLE 5 OVERVIEW OF KEY IMPACT CATEGORIES (CLASSES OF ENVIRONMENTAL IMPACT TO WHICH LIFE CYCLE INVENTORY DATA ARE RELATED) USED FOR THIS STUDY. IT ALSO INCLUDES RESPECTIVE INDICATORS (QUANTIFIABLE REPRESENTATION OF AN IMPACT CATEGORY) AND CHARACTERISATION FACTORS (FACTORS THAT REPRESENT THE IMPACT INTENSITY OF A SUBSTANCE RELATIVE TO THE COMMON UNIT OF THE IMPACT CATEGORY'S INDICATOR)

Impact category	Indicator	Characterisation Factor	Unit	Description
Impact categories belonging to the ReCiPe impact assessment method				
Climate change	Infrared radiative forcing increase	Global warming potential (GWP)	kg CO_2-eq to air	Increase in global average temperature by the emission of greenhouse gases. the widely used global warming potential (GWP) quantifies the integrated infrared radiative forcing increase of a greenhouse gas (GHG), expressed in kg CO_2-eq
Fine particulate matter formation	PM2.5 population intake increase	Particulate matter formation potential (PMFP)	kg PM2.5-eq to air	Fine Particulate Matter with a diameter of less than 2.5 µm (consisting of organic and inorganic substances) affects the respiratory tract and lungs when inhaled. Particulate matter formation potentials (PMFP) are expressed in kg primary PM2.5-equivalents.
Terrestrial acidification	Proton increase in natural soils	Terrestrial acidification potential (TAP)	kg SO_2-eq to air	Inorganic acids released into the atmosphere—such as sulphates, nitrates, and phosphates—which cause changes in the acidity of the soil. Acidification potentials considers the fate of a pollutant in the atmosphere and the soil.
Freshwater eutrophication	Phosphorus increase in freshwater	Freshwater eutrophication potential (FEP)	kg P-eq to freshwater	Accumulation of nutrients in water overstimulate plant growth, which reduces the level of oxygen. FEP is based on the fate of phosphorus, which is the limiting nutrient in freshwater.
Marine eutrophication	Dissolved inorganic nitrogen increase in marine water	Marine eutrophication potential (MEP)	Kg N-eq to marine water	Accumulation of nutrients in water overstimulate plant growth, which reduces the level of oxygen. MEP is based on the fate of and exposure to nitrogen, which is the limiting nutrient in marine waters.
Land use	Occupation and time-integrated land transformation	Agricultural land occupation potential (LOP)	$m^2 \times yr$ annual cropland-eq	The characterisation factor refers to the relative species loss caused by a specific land use type (e.g. annual crops, permanent crops, forestry, urban land, pasture) proportionate to the relative species loss resulting from annual crop production.
Water use	Increase of water consumed	Water consumption potential (WCP)	m^3 water-eq consumed	Quantity of water used, expressed as m3 of water consumed per m^3 of water extracted
Mineral resource scarcity	Increase of ore extracted	Surplus ore potential (SOP)	kg Cu-eq	The primary extraction of a mineral resource will lead to an overall decrease the concentration of that resource in ores worldwide. The SOP expresses the average extra amount of ore produced in the future caused by the extraction of a mineral resource considering all future production of that mineral resource.
Fossil resource scarcity	Upper heating value	Fossil fuel potential (FFP)	kg oil-eq	Depletion of resources that contain hydrocarbons, such as coal, oil or natural gas. FFP is defined as the ratio between the higher heating value of a fossil resource and the energy content of crude oil.
Additional impact category				
Land occupation	Land area	N/A	$m^2 \times yr$	Occupation or use of a certain area of land for a certain period of time. The inventory data is not characterised.

[4] The ReCiPe 2016 method for land use considers species richness in different land uses by applying a characterization factor (CF) by land type. Certain land types like forests, grassland and permanent crops get a lower characterisation factor (CF < 1) than annual crops (CF = 1). However, this method is somewhat outdated and only provides one global CF per land use type, without differentiating by location/geography, whereas biodiversity varies substantially by geography. Furthermore, the unit m2a crop-eq can be hard to interpret. To also provide an indication of the actual land surface used for each of the products, this addendum adds a land occupation indicator (m^2 of total land occupied per year), which does not characterise land use (CF = 1 for all land use types). Additional land impact assessment methods were evaluated in the sensitivity analysis in the main report, including the EF 3.0 method which uses the LANCA model to quantify land use.

Since the products in scope of this addendum are very similar to the products investigated in the main report, this report contains no sensitivity analyses. Only an uncertainty analysis is included.

The main report can be consulted to obtain more insight into results of the sensitivity analyses with regard to applying different impact assessment methods (EF 3.0, 20-year timeframe for global warming), applying a different scope (cradle-to-grave), applying different allocation methods (economic allocation for cow's milk) and applying a different functional unit (including nutritional characteristics).

3. Life Cycle Inventory

This addendum covers Oatly Barista produced at Oatly's end-to-end factory located in Landskrona, Sweden, and the hybrid factory located in Vlissingen, the Netherlands. More details on these factories and the production process can be found in section 3.1.1 of the main report.

The data used for the manufacturing of the Oatly products of this addendum is identical to Oatly Barista as described in section 3.1.2 of the main report, except for the following:

- The resource use at the factories (energy and water use) has been updated with 2022 data.
- The sourcing countries for oats have been updated for the Vlissingen factory.
- Transport from the factories to Poland, Ireland and France (to distribution centers and retail) has been added based on data provided by Oatly.

An overview of the data used to model the Oatly products can be found in Appendix II.

For the raw cow's milk from Poland, Ireland and France, data from Agri-footprint has been used, in line with the datasets used in the main report. An overview of the data that was used to generate these datasets can be found in Appendix III. Section 3.2 of the main report contains further information on how the subsequent life cycle stages were modelled.

4. Life Cycle Impact Assessment (LCIA)

This chapter provides an overview of the key results for all products in scope, whereas the next chapter (Life Cycle Interpretation) provides a more detailed account of the stages and processes contributing most to the impact.

The results for the key impact categories are listed in Table 6 for the ambient Oatly Barista, and in Table 7 for the chilled Oatly Barista. The results for all impact categories are included in Appendix IV. Table 8 and Table 9 provide an overview of the relative differences of the Oatly products and cow's milk.

These tables indicate that:

- For all countries, the ambient and chilled version of Oatly Barista have a lower impact than cow's milk when it comes to the environmental impact categories climate change, fine particulate matter formation, terrestrial acidification, freshwater eutrophication, marine eutrophication, land use, land occupation, and water consumption.
- For fossil resource scarcity, the ambient and chilled Oatly Barista have a higher impact than cow's milk for the French market, a comparable impact for the Irish market when sourced from the Vlissingen factory, and a lower impact for the Polish market (sourced from both factories) and for the Irish market when sourced from the Landskrona factory.
- For the mineral resource scarcity impact category, both the ambient and chilled Oatly Barista for the Irish market have a higher impact than Irish cow's milk. This is not the case for the French and Polish markets, where Oatly Barista has a lower impact.

Note that the differences observed between Oatly Barista and cow's milk is in some cases not significant, as is determined by the uncertainty analysis in chapter 5.2. A further explanation of what causes the differences that can be observed between products can be found in the next chapter (Life Cycle Interpretation)

These results are in line with the results from the main report on Oatly Barista, where relative differences between Oatly Barista and cow's milk are of the same order of magnitude for the same categories[5].

TABLE 6: RESULTS FOR KEY IMPACT CATEGORIES FOR THE AMBIENT OATLY BARISTA AND COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) PACKAGING. IT INCLUDES OATLY BARISTA PRODUCED IN THE HYBRID FACTORY LOCATED IN VLISSINGEN, THE NETHERLANDS AND IN THE END-TO-END FACTORY IN LANDSKRONA, SWEDEN. THE PRIMARY PRODUCTION LOCATION IS LISTED FIRST. COW'S MILK REPRESENTS AN AVERAGE COW'S MILK PRODUCT AT RETAIL FOR EACH COUNTRY. FURTHER INFORMATION ON THE INDICATORS USED FOR THE IMPACT CATEGORIES CAN BE FOUND IN TABLE 5.

France Retail				
Impact category		**Cow's milk average FR**	**Oatly Barista NL Factory**	***Difference compared to cow's milk***
Climate change - incl LUC and peat ox	kg CO_2 eq	1.197	0.578	*-52%*
Climate change - excl LUC and peat ox	kg CO_2 eq	1.094	0.446	*-59%*
Climate change - only LUC	kg CO_2 eq	0.099	0.018	*-81%*
Climate change - only peat ox	kg CO_2 eq	0.003	0.113	*3505%*
Fine particulate matter formation	kg PM2.5 eq	0.00219	0.000510	*-77%*
Terrestrial acidification	kg SO_2 eq	0.00507	0.00162	*-68%*
Freshwater eutrophication	kg P eq	0.000285	0.000145	*-49%*
Marine eutrophication	kg N eq	0.00181	0.000610	*-66%*
Land use	m^2a crop eq	1.092	0.659	*-40%*
Land occupation	m^2a	1.554	0.745	*-52%*
Mineral resource scarcity	kg Cu eq	0.00130	0.00124	*-5%*
Fossil resource scarcity	kg oil eq	0.100	0.125	*25%*
Water consumption	m^3	0.02451	0.00411	*-83%*

[5] When comparing the average relative difference between (ambient) Oatly Barista and cow's milk for the impact categories in scope, the Oatly products in this report have on average a relative lower impact than the Oatly products in the main report for all impact categories except for terrestrial acidification.

Ireland Retail						
Impact category	**Unit**	**Cow's milk average IE**	**Oatly Barista NL Factory**	***Difference compared to cow's milk***	**Oatly Barista SE Factory**	***Difference compared to cow's milk***
Climate change - incl LUC and peat ox	kg CO_2 eq	1.337	0.589	-56%	0.456	-66%
Climate change - excl LUC and peat ox	kg CO_2 eq	1.120	0.457	-59%	0.351	-69%
Climate change - only LUC	kg CO_2 eq	0.048	0.018	-61%	0.022	-53%
Climate change - only peat ox	kg CO_2 eq	0.170	0.113	-34%	0.082	-51%
Fine particulate matter formation	kg PM2.5 eq	0.00312	0.000640	-79%	0.000673	-78%
Terrestrial acidification	kg SO_2 eq	0.00341	0.00205	-40%	0.00235	-31%
Freshwater eutrophication	kg P eq	0.000320	0.000157	-51%	0.000145	-55%
Marine eutrophication	kg N eq	0.00215	0.000620	-71%	0.000598	-72%
Land use	m^2a crop eq	0.740	0.661	-11%	0.657	-11%
Land occupation	m^2a	1.073	0.749	-30%	0.746	-30%
Mineral resource scarcity	kg Cu eq	0.000867	0.00123	41%	0.00116	34%
Fossil resource scarcity	kg oil eq	0.142	0.132	-7%	0.081	-43%
Water consumption	m^3	0.00926	0.00401	-57%	0.00323	-65%

Poland retail						
Impact category	**Unit**	**Cow's milk average PL**	**Oatly Barista NL Factory**	***Difference compared to cow's milk***	**Oatly Barista SE Factory**	***Difference compared to cow's milk***
Climate change - incl LUC and peat ox	kg CO_2 eq	1.916	0.636	-67%	0.496	-74%
Climate change - excl LUC and peat ox	kg CO_2 eq	1.658	0.505	-70%	0.391	-76%
Climate change - only LUC	kg CO_2 eq	0.192	0.018	-90%	0.022	-88%
Climate change - only peat ox	kg CO_2 eq	0.065	0.113	73%	0.082	26%
Fine particulate matter formation	kg PM2.5 eq	0.00382	0.000600	-84%	0.000582	-85%
Terrestrial acidification	kg SO_2 eq	0.00942	0.00189	-80%	0.00202	-79%
Freshwater eutrophication	kg P eq	0.000788	0.000199	-75%	0.000192	-76%
Marine eutrophication	kg N eq	0.00205	0.000621	-70%	0.000600	-71%
Land use	m^2a crop eq	2.167	0.661	-69%	0.657	-70%
Land occupation	m^2a	2.546	0.749	-71%	0.747	-71%
Mineral resource scarcity	kg Cu eq	0.00186	0.00123	-34%	0.00118	-37%
Fossil resource scarcity	kg oil eq	0.191	0.145	-24%	0.091	-52%
Water consumption	m^3	0.0173	0.00497	-71%	0.00431	-75%

TABLE 7 RESULTS FOR KEY IMPACT CATEGORIES FOR THE CHILLED OATLY BARISTA AND COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) PACKAGING. IT INCLUDES OATLY BARISTA PRODUCED IN THE HYBRID FACTORY LOCATED IN VLISSINGEN, THE NETHERLANDS AND IN THE END-TO-END FACTORY. FURTHER INFORMATION ON THE INDICATORS USED FOR THE IMPACT CATEGORIES CAN BE FOUND IN TABLE 5.

France Retail				
Impact category	**Unit**	**Cow's milk average FR**	**Oatly Barista NL Factory**	***Difference compared to cow's milk***
Climate change - incl LUC and peat ox	kg CO_2 eq	1.197	0.609	-49%
Climate change - excl LUC and peat ox	kg CO_2 eq	1.094	0.472	-57%
Climate change - only LUC	kg CO_2 eq	0.099	0.024	-76%
Climate change - only peat ox	kg CO_2 eq	0.003	0.113	3516%
Fine particulate matter formation	kg PM2.5 eq	0.00219	0.000494	-77%
Terrestrial acidification	kg SO_2 eq	0.00507	0.00160	-68%
Freshwater eutrophication	kg P eq	0.000285	0.000140	-51%
Marine eutrophication	kg N eq	0.00181	0.000611	-66%
Land use	m^2a crop eq	1.092	0.668	-39%
Land occupation	m^2a	1.554	0.753	-52%
Mineral resource scarcity	kg Cu eq	0.00130	0.00101	-23%
Fossil resource scarcity	kg oil eq	0.100	0.123	23%
Water consumption	m^3	0.0245	0.00421	-83%

Ireland Retail						
Impact category	**Unit**	**Cow's milk average IE**	**Oatly Barista NL Factory**	***Difference compared to cow's milk***	**Oatly Barista SE Factory**	***Difference compared to cow's milk***
Climate change - incl LUC and peat ox	kg CO_2 eq	1.337	0.625	-53%	0.493	-63%
Climate change - excl LUC and peat ox	kg CO_2 eq	1.120	0.489	-56%	0.387	-65%
Climate change - only LUC	kg CO_2 eq	0.048	0.024	-50%	0.024	-50%
Climate change - only peat ox	kg CO_2 eq	0.170	0.113	-33%	0.083	-51%
Fine particulate matter formation	kg PM2.5 eq	0.00312	0.000676	-78%	0.000734	-76%
Terrestrial acidification	kg SO_2 eq	0.00341	0.00212	-38%	0.00246	-28%
Freshwater eutrophication	kg P eq	0.000320	0.000153	-52%	0.000142	-56%
Marine eutrophication	kg N eq	0.00215	0.000620	-71%	0.000598	-72%
Land use	m^2a crop eq	0.740	0.669	-10%	0.661	-11%
Land occupation	m^2a	1.073	0.758	-29%	0.751	-30%
Mineral resource scarcity	kg Cu eq	0.000867	0.00104	20%	0.00100	15%
Fossil resource scarcity	kg oil eq	0.142	0.134	-6%	0.087	-39%
Water consumption	m^3	0.00926	0.00409	-56%	0.00331	-64%
Poland retail						
Impact category	**Unit**	**Cow's milk average PL**	**Oatly Barista SE Factory**	***Difference compared to cow's milk***	**Oatly Barista NL Factory**	***Difference compared to cow's milk***
Climate change - incl LUC and peat ox	kg CO_2 eq	1.916	0.556	-71%	0.699	-64%
Climate change - excl LUC and peat ox	kg CO_2 eq	1.658	0.449	-73%	0.562	-66%
Climate change - only LUC	kg CO_2 eq	0.192	0.024	-88%	0.024	-88%
Climate change - only peat ox	kg CO_2 eq	0.065	0.083	27%	0.113	73%
Fine particulate matter formation	kg PM2.5 eq	0.00382	0.000609	-84%	0.000612	-84%
Terrestrial acidification	kg SO_2 eq	0.00942	0.00210	-78%	0.00196	-79%
Freshwater eutrophication	kg P eq	0.000788	0.000201	-74%	0.000207	-74%
Marine eutrophication	kg N eq	0.00205	0.000601	-71%	0.000622	-70%
Land use	m^2a crop eq	2.167	0.661	-69%	0.670	-69%
Land occupation	m^2a	2.546	0.752	-70%	0.759	-70%
Mineral resource scarcity	kg Cu eq	0.00186	0.00096	-48%	0.00100	-46%
Fossil resource scarcity	kg oil eq	0.191	0.097	-49%	0.148	-22%
Water consumption	m^3	0.0173	0.00472	-73%	0.00539	-69%

TABLE 8 RELATIVE DIFFERENCES OF AMBIENT OATLY BARISTA COMPARED TO COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) OF PACKAGING. FOR EXAMPLE, -58% INDICATES THAT OATLY BARISTA HAS A 58% LOWER IMPACT COMPARED TO COW'S MILK. THE DIFFERENCES HAVE BEEN COLOR-CODED AS FOLLOWS: GREEN – MORE THAN 10% DIFFERENCE FAVORING OATLY BARISTA, YELLOW – THE DIFFERENCE IS 10% OR LOWER INDICATING SIMILAR PERFORMANCE FOR THE COMPARED PRODUCTS, RED – MORE THAN 10% DIFFERENCE FAVORING COW'S MILK. FOR OATLY BARISTA, THE PRIMARY OATLY PRODUCTION FACILITY IS LISTED FIRST, FOLLOWED BY THE SECONDARY OATLY PRODUCTION FACILITY. COW'S MILK REPRESENTS AN AVERAGE MILK PRODUCT AT RETAIL FOR EACH COUNTRY. ABBREVIATIONS USED: NL = THE NETHERLANDS AND SE = SWEDEN. FURTHER INFORMATION ON THE INDICATORS USED FOR THE IMPACT CATEGORIES CAN BE FOUND IN TABLE 5.

Country of sale	**Product**	**Climate change** *kg CO2 eq*	**Fine particulate matter** *kg PM2.5 eq*	**Terrestrial acidification** *kg SO2 eq*	**Freshwater eutrophication** *kg P eq*	**Marine eutrophication** *kg N eq*	**Land use** *m2a crop eq*	**Land occupation** *m2a*	**Mineral resource scarcity** *kg Cu eq*	**Fossil resource scarcity** *kg oil eq*	**Water consumption** *m3*
France Retail	Oatly Barista NL Factory	-52%	-77%	-68%	-49%	-66%	-40%	-52%	-5%	25%	-83%
Ireland Retail	Oatly Barista NL Factory	-56%	-79%	-40%	-51%	-71%	-11%	-30%	41%	-7%	-57%
	Oatly Barista SE Factory	-66%	-78%	-31%	-55%	-72%	-11%	-30%	34%	-43%	-65%
Poland retail	Oatly Barista NL Factory	-67%	-84%	-80%	-75%	-70%	-69%	-71%	-34%	-24%	-71%
	Oatly Barista SE Factory	-74%	-85%	-79%	-76%	-71%	-70%	-71%	-37%	-52%	-75%

TABLE 9 RELATIVE DIFFERENCES OF OATLY BARISTA CHILLED COMPARED TO COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) OF PACKAGING. FOR EXAMPLE, -58% INDICATES THAT OATLY BARISTA HAS A 58% LOWER IMPACT COMPARED TO COW'S MILK. THE DIFFERENCES HAVE BEEN COLOR-CODED AS FOLLOWS: GREEN – MORE THAN 10% DIFFERENCE FAVORING OATLY BARISTA, YELLOW – THE DIFFERENCE IS 10% OR LOWER INDICATING SIMILAR PERFORMANCE FOR THE COMPARED PRODUCTS, RED – MORE THAN 10% DIFFERENCE FAVORING COW'S MILK. FOR OATLY BARISTA, THE PRIMARY OATLY PRODUCTION FACILITY IS LISTED FIRST, FOLLOWED BY THE SECONDARY OATLY PRODUCTION FACILITY. COW'S MILK REPRESENTS AN AVERAGE MILK PRODUCT AT RETAIL FOR EACH COUNTRY. ABBREVIATIONS USED: NL = THE NETHERLANDS AND SE = SWEDEN. FURTHER INFORMATION ON THE INDICATORS USED FOR THE IMPACT CATEGORIES CAN BE FOUND IN TABLE 5.

Country of sale	Product	Climate change *kg CO2 eq*	Fine particulate matter *kg PM2.5 eq*	Terrestrial acidifi-cation *kg SO2 eq*	Freshwater eutrophi-cation *kg P eq*	Marine eutrophi-cation *kg N eq*	Land use *m2a crop eq*	Land occupation *m2a*	Mineral resource scarcity *kg Cu eq*	Fossil resource scarcity *kg oil eq*	Water consum-ption *m3*
France Retail	Oatly Barista NL Factory	-49%	-77%	-68%	-51%	-66%	-39%	-52%	-23%	23%	-83%
Ireland Retail	Oatly Barista NL Factory	-53%	-78%	-38%	-52%	-71%	-10%	-29%	20%	-6%	-56%
	Oatly Barista SE Factory	-63%	-76%	-28%	-56%	-72%	-11%	-30%	15%	-39%	-64%
Poland retail	Oatly Barista SE Factory	-71%	-84%	-78%	-74%	-71%	-69%	-70%	-48%	-49%	-73%
	Oatly Barista NL Factory	-64%	-84%	-79%	-74%	-70%	-69%	-70%	-46%	-22%	-69%

5. Life Cycle Interpretation

5.1 Contribution analysis

A contribution analysis shows the contribution of individual life cycle stages to the overall impact results. Contribution analyses are provided for all products in scope and for all key impact categories. Section 5.1.1 of the main report explains in detail which processes contribute to the different impact categories and can be consulted to better understand what is behind the results and the differences that can be observed between the Oatly products and cow's milk. Notable differences from the main report are included below.

5.1.1 Comparison of Oatly Barista and cow's milk

The contribution analysis for the climate change impact category is shown in Figure 3 for ambient Oatly Barista, and in Figure 4 for the chilled Oatly Barista. Figure 5 shows the contribution analysis for the other impact categories, with graphs including both the ambient and chilled version of Oatly Barista.

FIGURE 3: CLIMATE CHANGE IMPACT OF AMBIENT OATLY BARISTA AND COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) OF PACKAGING. IT INCLUDES OATLY BARISTA PRODUCED IN THE HYBRID FACTORY LOCATED IN VLISSINGEN, THE NETHERLANDS AND IN THE END-TO-END FACTORY IN LANDSKRONA, SWEDEN. THE PRIMARY PRODUCTION FACILITY IS LISTED FIRST, FOLLOWED BY THE SECONDARY PRODUCTION FACILITY. COW'S MILK REPRESENTS AN AVERAGE COW'S MILK PRODUCT AT RETAIL FOR EACH COUNTRY. ABBREVIATIONS USED: NL = THE NETHERLANDS, SE = SWEDEN, FR = FRANCE, IE = IRELAND, AND PL = POLAND

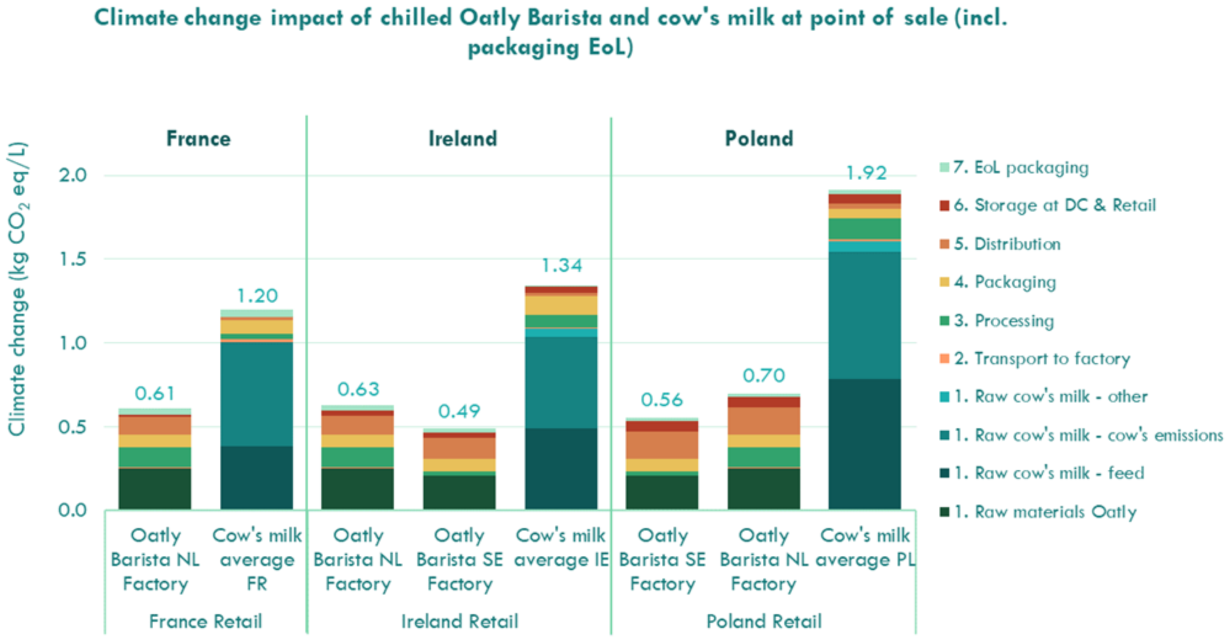


FIGURE 4 CLIMATE CHANGE IMPACT OF CHILLED OATLY BARISTA AND COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) OF PACKAGING. IT INCLUDES OATLY BARISTA PRODUCED IN THE HYBRID FACTORY LOCATED IN VLISSINGEN, THE NETHERLANDS AND IN THE END-TO-END FACTORY IN LANDSKRONA, SWEDEN. THE PRIMARY PRODUCTION FACILITY IS LISTED FIRST, FOLLOWED BY THE SECONDARY PRODUCTION FACILITY. COW'S MILK REPRESENTS AN AVERAGE COW'S MILK PRODUCT AT RETAIL FOR EACH COUNTRY. ABBREVIATIONS USED: NL = THE NETHERLANDS, SE = SWEDEN, FR = FRANCE, IE = IRELAND, AND PL = POLAND

The results from Figure 3, Figure 4 and Figure 5 show that, similar to the results in the main report, the raw material stage is for the Oatly products the **largest contributor** to the climate change impact category, as well as most other impact categories. Exceptions are the mineral resource scarcity category, which is mainly linked to packaging (with a high impact for the ambient beverage carton due to use of aluminium), the water consumption category, which is mainly linked to water consumption at the Oatly factories), and the fossil resource scarcity category, which is mainly linked to distribution (with Oatly products having longer distribution distances than the locally produced cow's milk) and use of natural gas for processing at the Vlissingen factory (as opposed to biogas used in the Landskrona factory).

Oatly Barista produced in the Vlissingen factory has a relatively high **fossil resource scarcity impact** (Figure 5g) due to the use of natural gas (for heat) during processing. The processing impact for cow's milk is lower as less heat is required. For French cow's milk the processing impact is lower than for Poland and Ireland due to a higher share of nuclear energy in the national electricity mix. The distribution stage of Oatly Barista has a higher impact for fossil resource scarcity due to the longer distribution distances of Oatly Barista compared to the locally produced cow's milk.

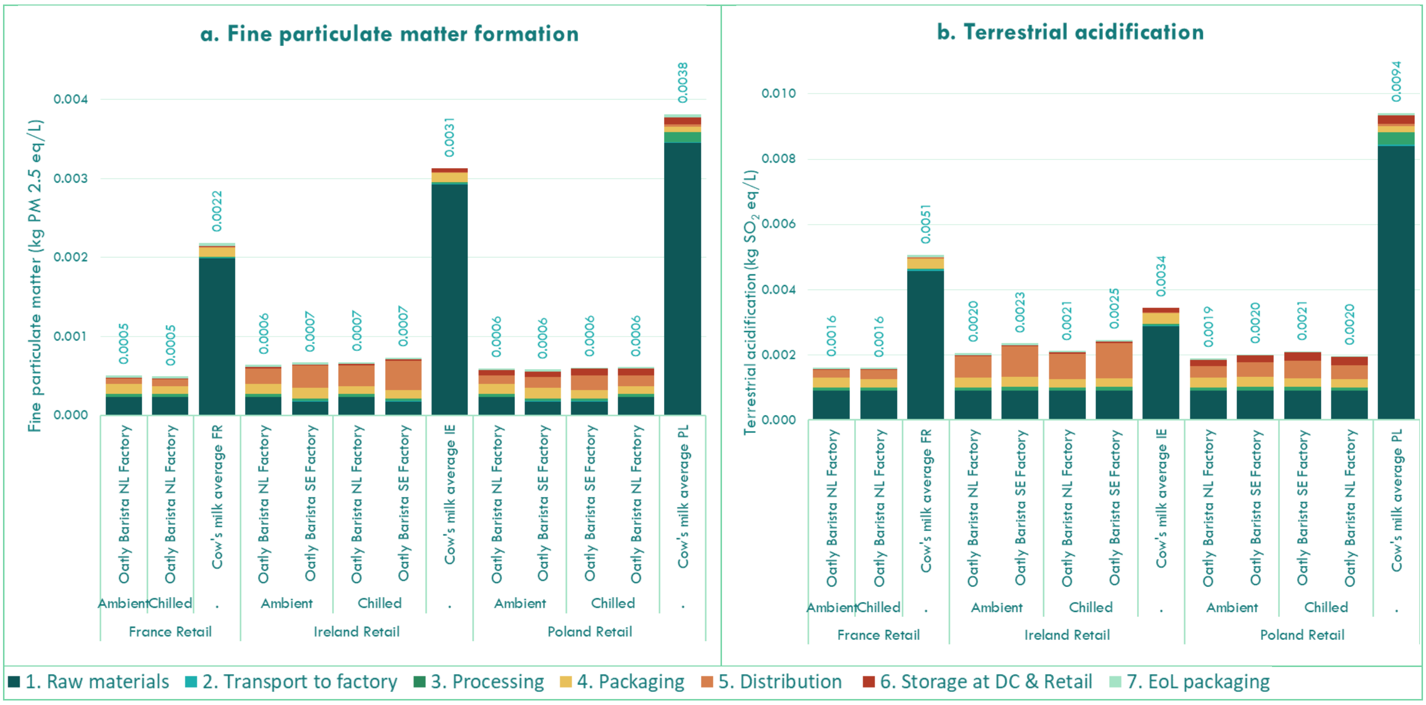
The relatively high **mineral resource scarcity impact** (Figure 5f) of Oatly Barista can be explained by the use of aluminium in the ambient beverage carton, as well as the use of renewable energy for processing (minerals used for the wind turbines). The relatively high mineral resource scarcity impact for the distribution stage of some of the Oatly products destined for Ireland and Poland can be explained by the use of chilled transport by ship. The mineral resources scarcity of Irish milk is relatively low due to the high share of grass in the cows' ration, which uses relatively fewer inputs of mineral fertilizers compared to compound feed. Differences related to packaging are explained below.

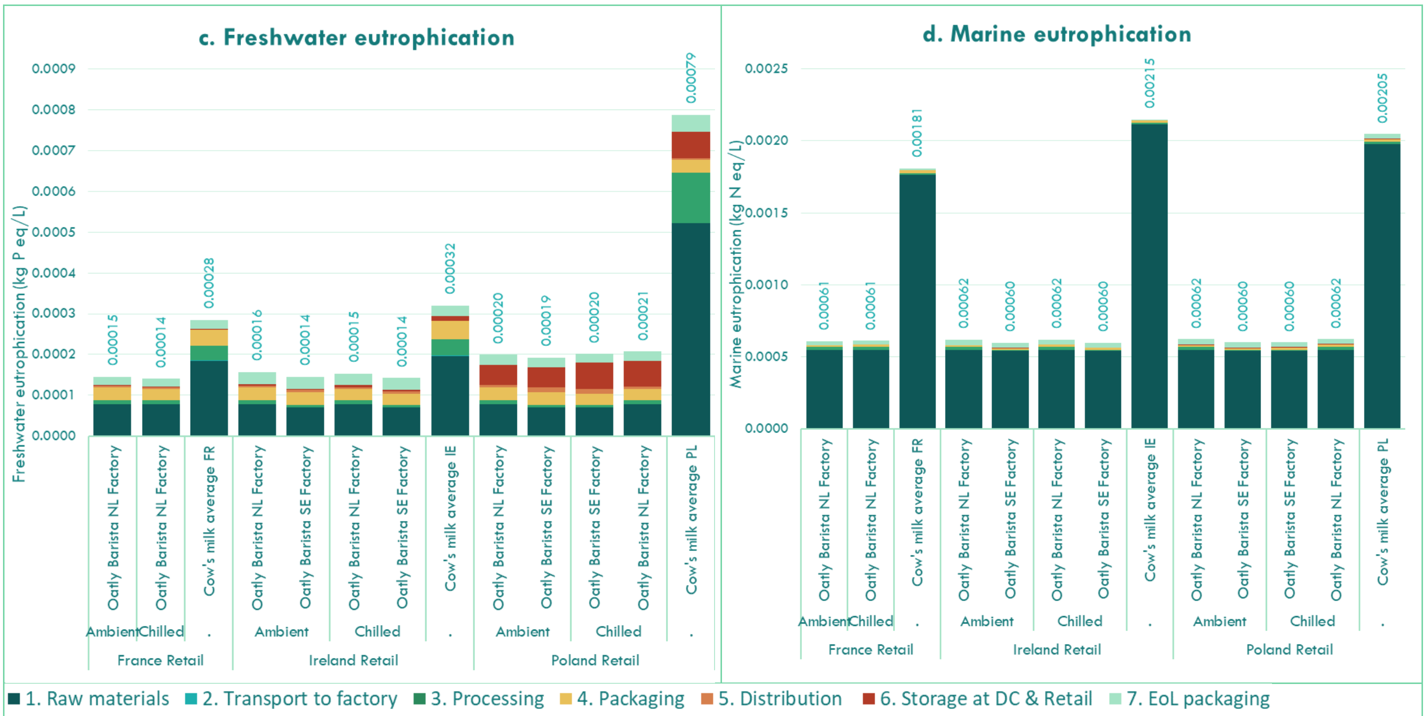
Even though the **land use** (Figure 5e) **and land occupation** (Figure 5e*) **impacts** are higher for cow's milk than for Oatly Barista, in the case of Ireland this difference is only marginal. For cow's milk, the impact results for land use and land occupation are dominated by feed cultivation. The feed consumed by the cows in Ireland consists of a comparatively high share of grass, which has a low land occupation impact because of its high yields. The land use and land occupation impact of packaging is mainly attributable to the carton board used in the beverage cartons for Oatly Barista and cow's milk (except for Irish cow's milk, for which a plastic bottle is considered).

For the Polish market, it can be observed that the **impact from the storage** at the distribution center and at retail is notably higher compared to the two other countries for several impact categories (climate change, fine particulate matter formation, terrestrial acidification, fossil resource scarcity, and water consumption). This is due to the relatively high environmental impact of the electricity used in Poland, where hard coal and lignite make up a large share of the electricity mix.

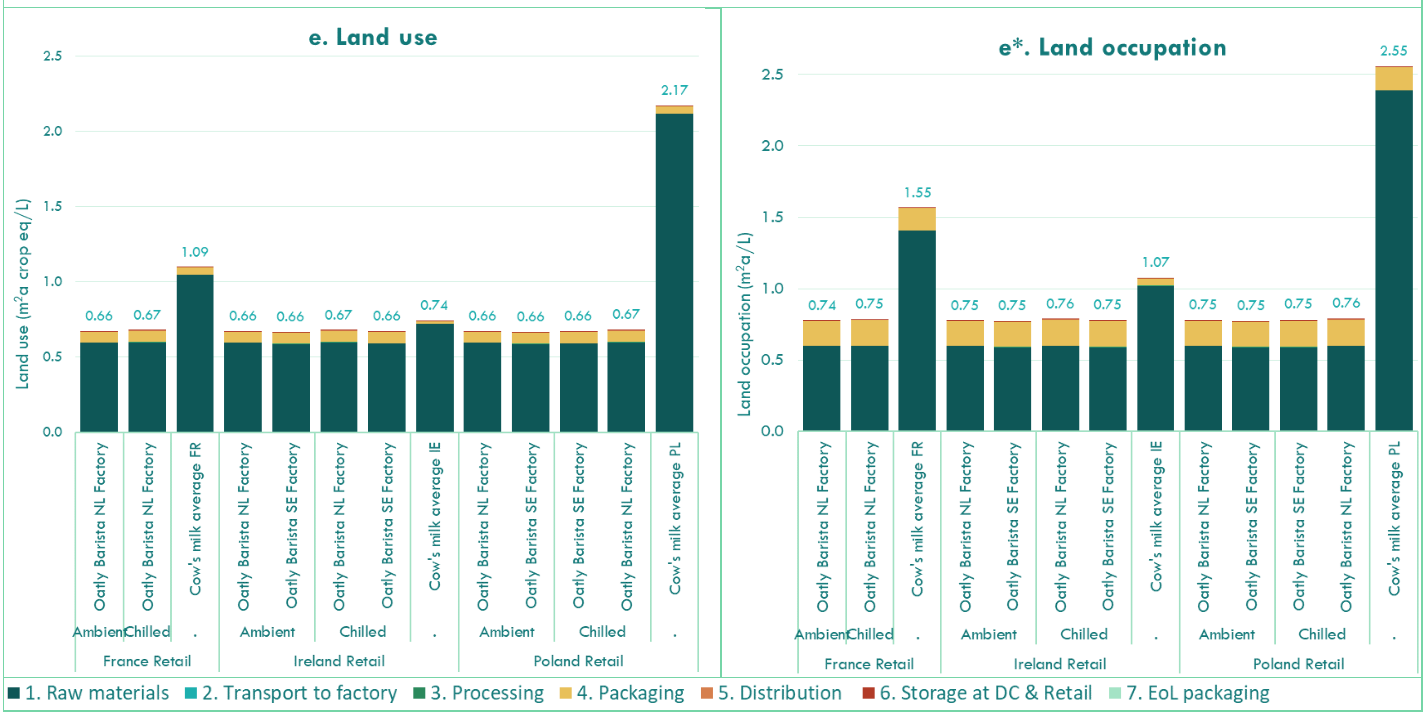
The main differences in the **impacts of packaging** among Oatly products can be explained by the addition of aluminium to the ambient beverage carton, which results in a higher impact compared to the chilled version for mineral resource scarcity. The packaging of cow's milk in Ireland, a plastic bottle, has a higher impact for climate change and fossil resource scarcity compared to the beverage cartons used in other countries (though it has a negative fossil resource scarcity impact for end-of-life since the plastic is only partially recycled). The chilled beverage carton used as packaging in Poland has a lower climate change impact than corresponding packaging of Oatly Barista, since Oatly Barista uses BioPE in its beverage cartons, which has a relatively high climate change impact due to the land use change impact associated with sugarcane cultivation in Brazil. However, the use of BioPE as opposed to fossil-based PE results in a lower impact for Oatly's packaging for the fossil resource scarcity impact category.

It is worth mentioning, that even if the scope of this report is not to compare results with the main report, Oatly's processing stage in the Vlissingen factory has seen a slight reduction in impact for climate change, mineral resource scarcity and water consumption. This is due to a switch in their electricity source, from hydropower to wind power, since the main report was published.





c. Freshwater eutrophication
Freshwater eutrophication (kg P eq/L)
0.0009
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
0.00015
0.00014
0.00028
0.00016
0.00014
0.00015
0.00014
0.00032
0.00020
0.00019
0.00020
0.00021
0.00079
Oatly Barista NL Factory
Oatly Barista NL Factory
Cow's milk average FR
Oatly Barista NL Factory
Oatly Barista SE Factory
Oatly Barista NL Factory
Oatly Barista SE Factory
Cow's milk average IE
Oatly Barista NL Factory
Oatly Barista SE Factory
Oatly Barista SE Factory
Oatly Barista NL Factory
Cow's milk average PL
Ambient
Chilled
Ambient
Chilled
Ambient
Chilled
France Retail
Ireland Retail
Poland Retail
d. Marine eutrophication
Marine eutrophication (kg N eq/L)
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
0.00061
0.00061
0.00181
0.00062
0.00060
0.00062
0.00060
0.00215
0.00062
0.00060
0.00060
0.00062
0.00205
Oatly Barista NL Factory
Oatly Barista NL Factory
Cow's milk average FR
Oatly Barista NL Factory
Oatly Barista SE Factory
Oatly Barista NL Factory
Oatly Barista SE Factory
Cow's milk average IE
Oatly Barista NL Factory
Oatly Barista SE Factory
Oatly Barista SE Factory
Oatly Barista NL Factory
Cow's milk average PL
Ambient
Chilled
Ambient
Chilled
Ambient
Chilled
France Retail
Ireland Retail
Poland Retail
1. Raw materials
2. Transport to factory
3. Processing
4. Packaging
5. Distribution
6. Storage at DC & Retail
7. EoL packaging



e. Land use
Land use (m²a crop eq/L)
2.5
2.0
1.5
1.0
0.5
0.0
0.66
0.67
1.09
0.66
0.66
0.67
0.66
0.74
0.66
0.66
0.66
0.67
2.17
Oatly Barista NL Factory
Oatly Barista NL Factory
Cow's milk average FR
Oatly Barista NL Factory
Oatly Barista SE Factory
Oatly Barista NL Factory
Oatly Barista SE Factory
Cow's milk average IE
Oatly Barista NL Factory
Oatly Barista SE Factory
Oatly Barista SE Factory
Oatly Barista NL Factory
Cow's milk average PL
Ambient
Chilled
Ambient
Chilled
Ambient
Chilled
France Retail
Ireland Retail
Poland Retail
e*. Land occupation
Land occupation (m²a/L)
2.5
2.0
1.5
1.0
0.5
0.0
0.74
0.75
1.55
0.75
0.75
0.76
0.75
1.07
0.75
0.75
0.75
0.76
2.55
Oatly Barista NL Factory
Oatly Barista NL Factory
Cow's milk average FR
Oatly Barista NL Factory
Oatly Barista SE Factory
Oatly Barista NL Factory
Oatly Barista SE Factory
Cow's milk average IE
Oatly Barista NL Factory
Oatly Barista SE Factory
Oatly Barista SE Factory
Oatly Barista NL Factory
Cow's milk average PL
Ambient
Chilled
Ambient
Chilled
Ambient
Chilled
France Retail
Ireland Retail
Poland Retail
1. Raw materials
2. Transport to factory
3. Processing
4. Packaging
5. Distribution
6. Storage at DC & Retail
7. EoL packaging

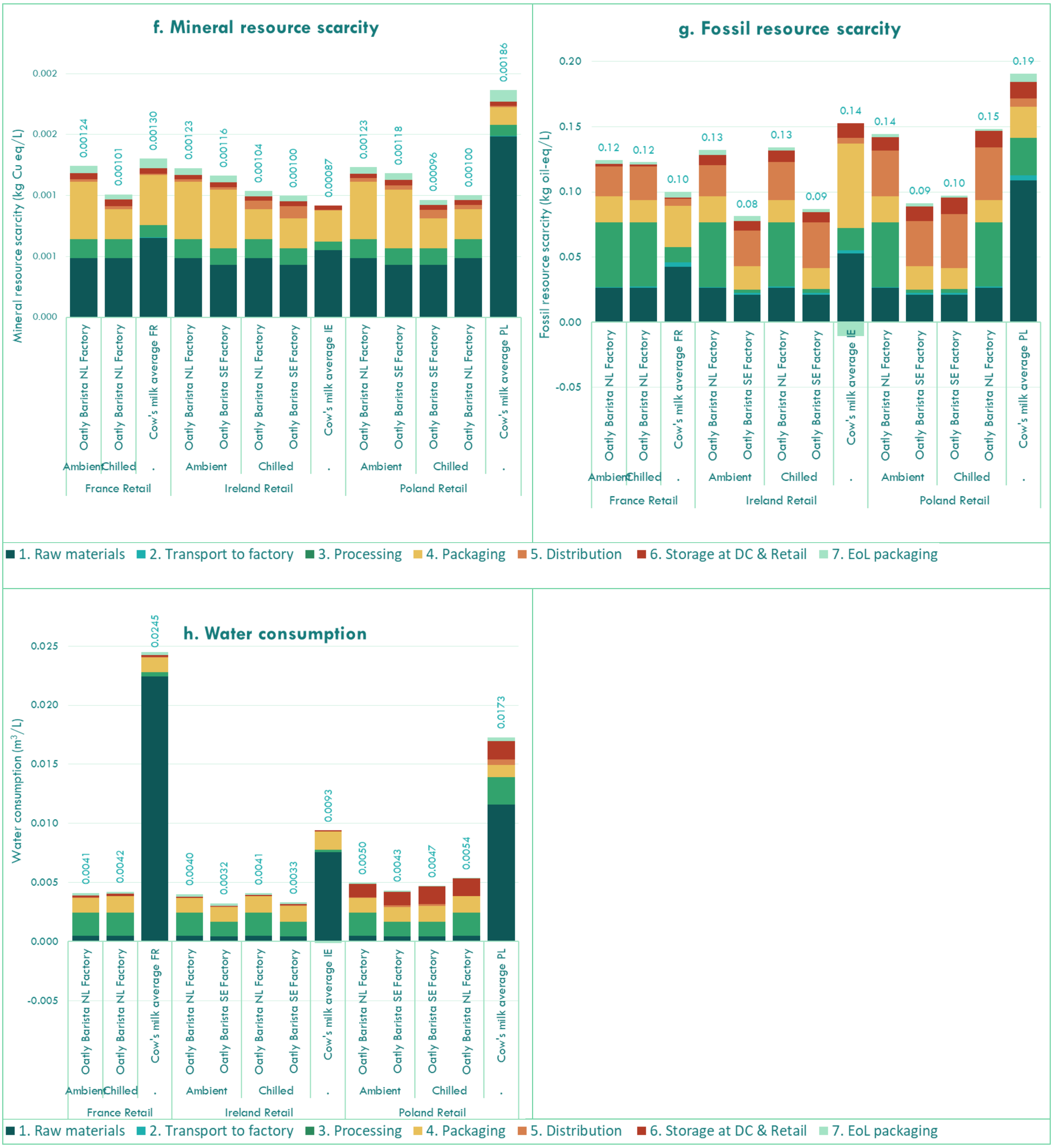
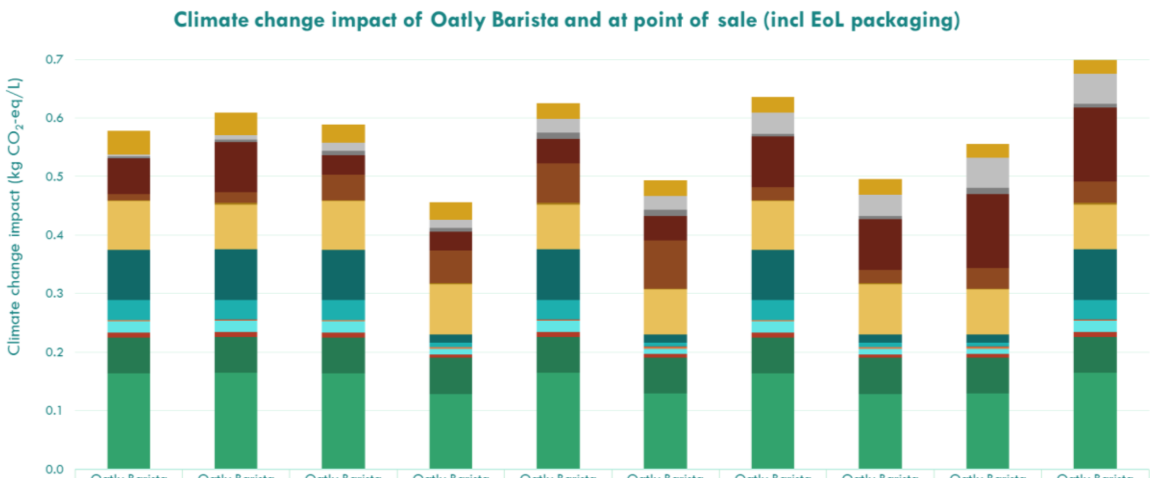


FIGURE 5: KEY IMPACT CATEGORIES OF OATLY BARISTA (CHILLED AND AMBIENT), AND COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) OF PACKAGING. IT INCLUDES OATLY BARISTA PRODUCED IN THE HYBRID FACTORY LOCATED IN VLISSINGEN, THE NETHERLANDS AND IN THE END-TO-END FACTORY IN LANDSKRONA, SWEDEN. THE PRIMARY PRODUCTION FACILITY IS LISTED FIRST, FOLLOWED BY THE SECONDARY PRODUCTION FACILITY. COW'S MILK REPRESENTS AN AVERAGE COW'S MILK PRODUCT AT RETAIL FOR EACH COUNTRY. IMPACT CATEGORY E* (LAND OCCUPATION) CONCERNS AN ADDITIONAL IMPACT CATEGORY AS EXPLAINED IN CHAPTER 2. ABBREVIATIONS USED: NL = THE NETHERLANDS, SE = SWEDEN, FR = FRANCE, IE = IRELAND, AND PL = POLAND

5.1.2 Oatly Barista

Figure 6 shows a detailed contribution analysis for the climate change impact category for Oatly Barista. For all countries, the chilled version of Oatly Barista has a higher climate change impact than the ambient version, due to the additional impact related to refrigerated transport and storage. Furthermore, the difference between products can be explained by the transport distances from the factories to the distribution centres and retail in the different countries.



	France Retail		Ireland Retail				Poland Retail			
	Ambient	Chilled	Ambient		Chilled		Ambient		Chilled	
	Oatly Barista NL Factory	Oatly Barista NL Factory	Oatly Barista NL Factory	Oatly Barista SE Factory	Oatly Barista NL Factory	Oatly Barista SE Factory	Oatly Barista NL Factory	Oatly Barista SE Factory	Oatly Barista SE Factory	Oatly Barista NL Factory
10. End of Life of Packaging	0.041	0.038	0.030	0.030	0.027	0.027	0.028	0.027	0.023	0.023
9b. Storage at retail	0.003	0.007	0.015	0.015	0.023	0.023	0.036	0.036	0.052	0.052
9a. Storage at DC	0.003	0.005	0.007	0.005	0.012	0.010	0.004	0.006	0.011	0.006
8b. Distribution to Retail	0.061	0.086	0.033	0.033	0.042	0.042	0.086	0.086	0.126	0.126
8a. Distribution to DC	0.011	0.017	0.044	0.055	0.067	0.083	0.023	0.022	0.035	0.036
7b. Transport of packaging material	0.001	0.003	0.001	0.002	0.003	0.001	0.001	0.002	0.001	0.003
7a. Packaging	0.083	0.076	0.083	0.086	0.076	0.077	0.083	0.086	0.077	0.076
6. Processing - Oatly Barista	0.086	0.087	0.086	0.014	0.087	0.014	0.086	0.014	0.014	0.087
5. Processing - oat base	0.034	0.034	0.034	0.007	0.034	0.007	0.034	0.007	0.007	0.034
4b. Transport of other ingredients to factory	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.001
4a. Transport of oats to factory	0.002	0.002	0.002	0.003	0.002	0.003	0.002	0.003	0.003	0.002
3. Oats milling	0.019	0.019	0.019	0.009	0.019	0.009	0.019	0.009	0.009	0.019
2. Oats transport to mill	0.008	0.008	0.008	0.006	0.008	0.006	0.008	0.006	0.006	0.008
1b. Other ingredient production	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061
1a. Oat cultivation	0.164	0.165	0.164	0.129	0.165	0.129	0.164	0.129	0.129	0.165

FIGURE 6: CLIMATE CHANGE IMPACT OF OATLY BARISTA AMBIENT AND CHILLED AT RETAIL INCLUDING END-OF-LIFE (EOL) OF PACKAGING. IT INCLUDES OATLY BARISTA PRODUCED IN THE HYBRID FACTORY LOCATED IN VLISSINGEN, THE NETHERLANDS AND IN THE END-TO-END FACTORY IN LANDSKRONA, SWEDEN. THE PRIMARY PRODUCTION FACILITY IS LISTED FIRST, FOLLOWED BY THE SECONDARY PRODUCTION FACILITY (NOT APPLICABLE TO FRANCE). ABBREVIATIONS USED: NL = THE NETHERLANDS, SE = SWEDEN, FR = FRANCE, IE = IRELAND, AND PL = POLAND

5.1.3 Cow's milk

Figure 7 shows the contribution analysis for climate change impact of raw cow's milk. As further explained in the main report, most of the climate change impact comes from the biogenic methane emissions originating primarily from enteric fermentation and manure management. Manure management systems with liquid storage systems, as dominantly used in France and Poland, generally lead to comparatively higher methane emissions (due to anaerobic conditions) than pit storage, which is dominant in Ireland. For Poland, the contribution of feed is higher than the other two countries due to the relatively high share of compound feed in the cows' diets, which has a relatively higher carbon footprint than grass or roughages.

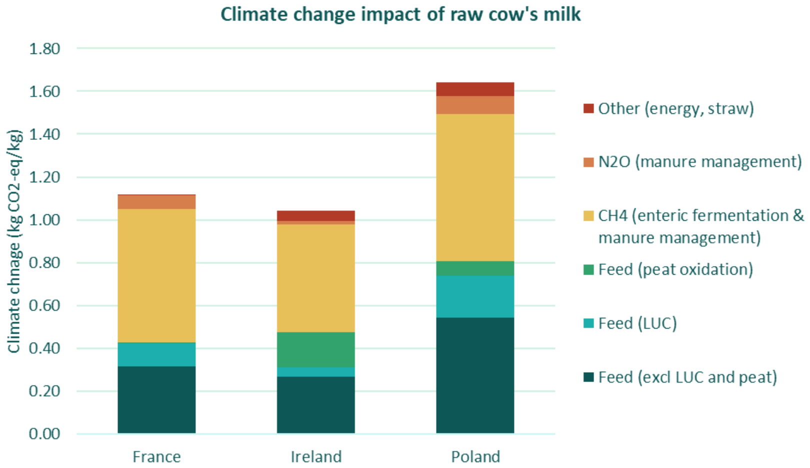


FIGURE 7 CONTRIBUTION ANALYSIS FOR THE CLIMATE CHANGE IMPACT OF RAW COW'S MILK IN POLAND, IRELAND, AND FRANCE.

5.2 Sensitivity and uncertainty analyses

Sensitivity analyses serve to evaluate the robustness of the results by assessing the influence of several assumptions and modelling choices that have been made. In the main report, sensitivity analyses were performed to evaluate the choice of impact assessment method, the choice of functional unit, the choice of allocation method, as well as several choices with regard to characteristics of the systems under study (e.g. inclusion of use stage, comparison to the ambient version of cow's milk). Next to that, an uncertainty analysis has been performed to determine the range in outcomes when considering uncertainties with regard to data quality.

These sensitivity analyses in the main report demonstrated that using a different impact assessment method (ReCiPe endpoint, EF3.0 single score) confirmed that Oatly Barista has a lower impact that cow's milk for the majority of impact categories for all countries in scope. It also showed that results in the impact categories land use, mineral resource scarcity and water impact categories are less robust, as they result in different trends when using a different impact assessment method (EF 3.0) because of their different underlying metrics. Furthermore, the sensitivity analyses in the main report concluded that using different product characteristics (inclusion of use stage, using economic allocation for cow's milk), did not lead to different conclusions on the environmental footprint of Oatly Barista compared to cow's milk.

Considering how similar the Oatly products in this study are to the Oatly Barista investigated in the main report (and having a relatively lower impact)[6], it was not deemed necessary to repeat all sensitivity analyses. The

[6] When comparing the average relative difference between (ambient) Oatly Barista and cow's milk for the impact categories in scope, the Oatly products in this report have on average a relatively lower impact than the Oatly products in the main report for all impact categories except for terrestrial acidification.

conclusions that were drawn based on the sensitivity analyses in the main report also apply to the products in this addendum. This chapter therefore just includes an uncertainty analysis.

Uncertainty in inventory data has been determined using the pedigree matrix, as described in section 2.4.1 of the main report. With this data, a Monte Carlo analysis was run in SimaPro to assess the uncertainty range for each product.

Figure 8 shows the climate change impact results including uncertainty ranges for the 95% confidence interval; meaning that of the 1000 times that the analysis has been repeated, 95% of the intervals that were generated include the true mean value. The graph shows a higher uncertainty range for cow's milk, which is caused by the higher uncertainty factors attributed to emissions from manure management and enteric fermentation and to feed intake (see section 2.7.1 of the main report). Oatly Barista has lower uncertainty ranges due to the use of primary (foreground) data.

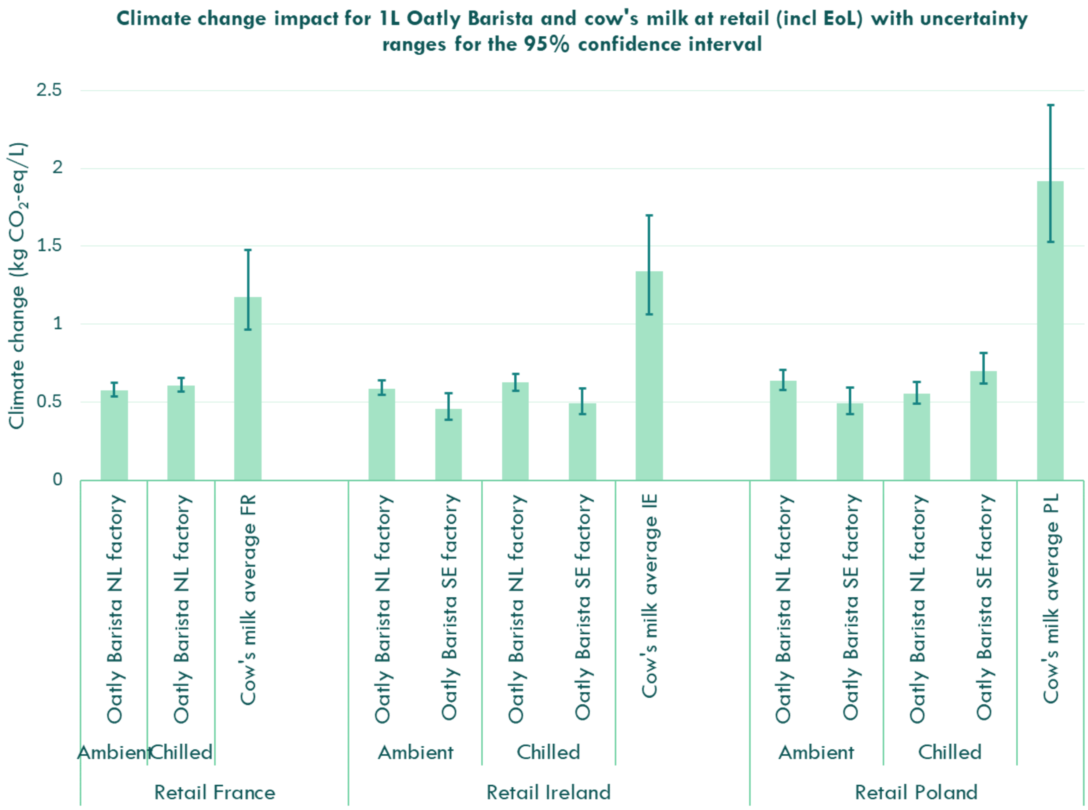


FIGURE 8 CLIMATE CHANGE IMPACT FOR 1L OATLY BARISTA AND COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) PACKAGING, WITH UNCERTAINTY RANGES FOR THE 95% CONFIDENCE INTERVAL.

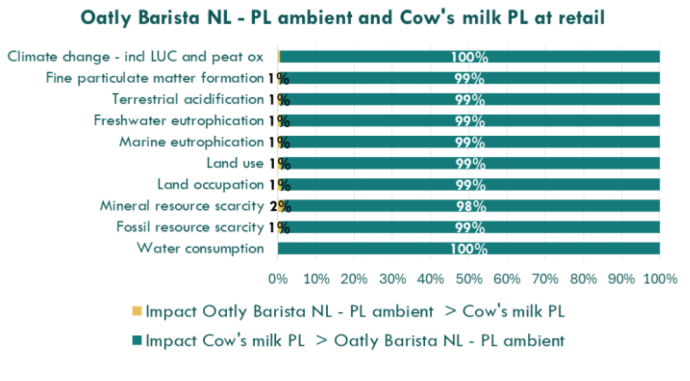
The graph gives an impression of how Oatly Barista compares to cow's milk when taking these uncertainties into consideration. Generally speaking, if the error bars of the 95% uncertainty interval do not overlap, one can assume differences between products are statistically significant (Payton et al., 2003).

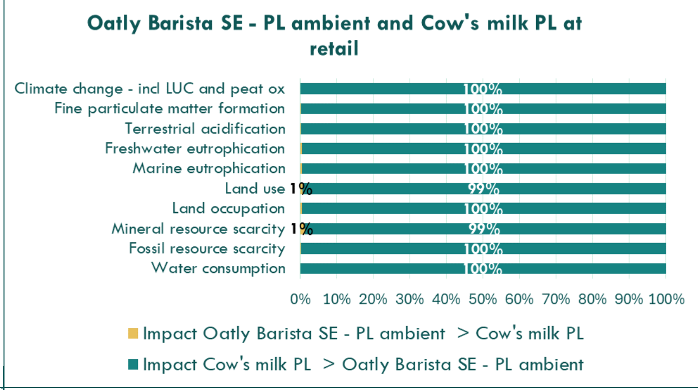
A more accurate way to compare two products is a paired Monte Carlo analysis, which considers the uncertainty of the difference between two products (thus accounting for correlation in data). The number of runs (from the total of 1000 runs) is counted in which product A has a higher impact than product B. In general, it can be assumed that if >90% of the Monte Carlo runs are favourable for one product, the difference can be considered significant (Goedkoop et al., 2013).

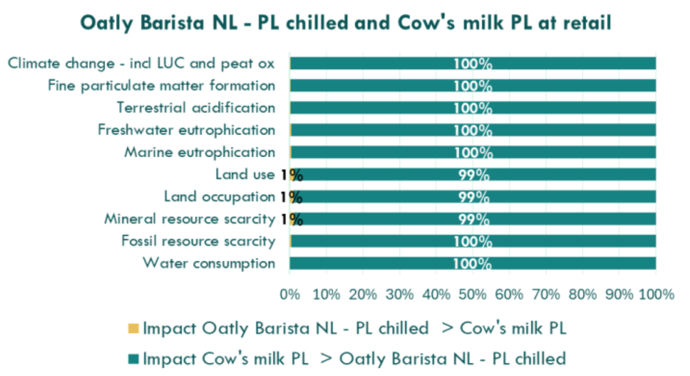
Figure 9 below shows the outcome of this paired Monte Carlo analysis for all products in scope, and for all impact categories. It shows that for climate change, fine particulate matter formation, terrestrial acidification, freshwater eutrophication, marine eutrophication and land occupation, the impact of Oatly Barista is consistently and significantly lower than the impact of cow's milk. When it comes to fossil resource scarcity, the impact of ambient and chilled Oatly Barista is lower for the Polish and Irish market (though not significant for the Oatly Barista in Ireland sourced from the Vlissingen factory), but higher for the French market. For land use, the impact of Oatly Barista is lower than cow's milk in all cases, but the difference is not significant in case of Oatly Barista sold in Ireland. For water consumption, the impact is lower for all Oatly products. For mineral resource scarcity, the differences between Oatly Barista and cow's milk varies between significantly higher, lower or insignificant.

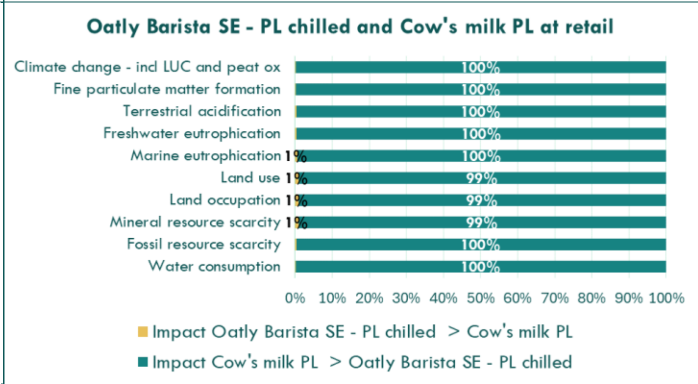
It should be noted that the results shown here concern just an approximation rather than an accurate reflection of uncertainty ranges, as uncertainty was estimated for the data in absence of information on variability of the data.

Poland

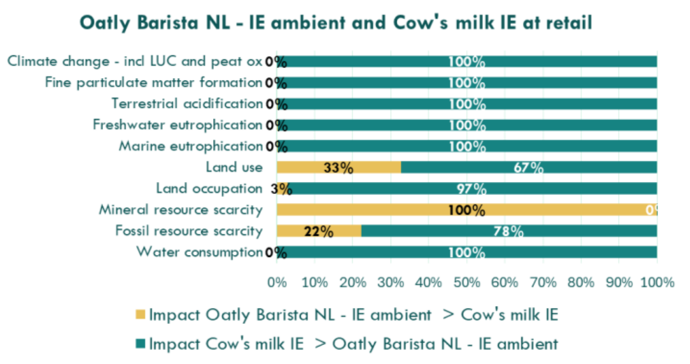


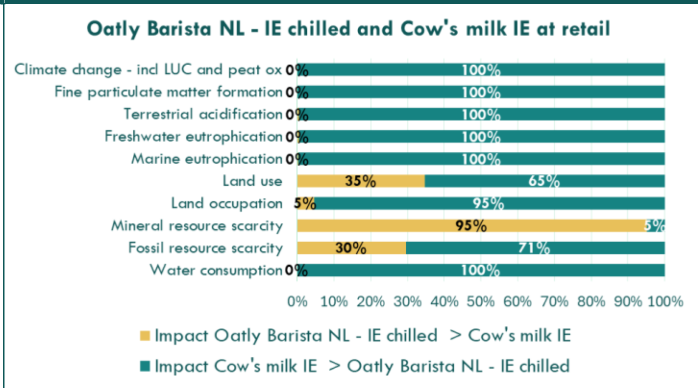






Ireland





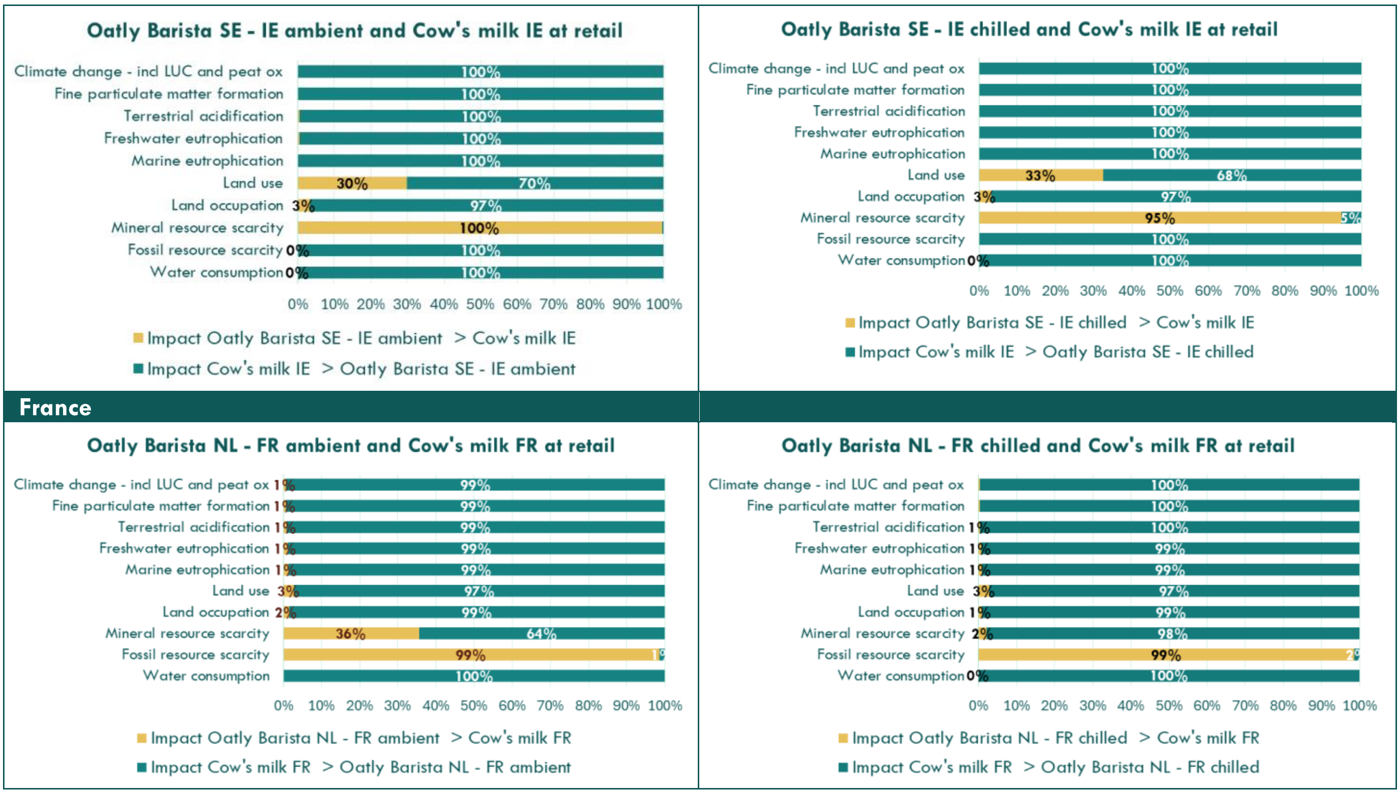


FIGURE 9 PAIRED MONTE CARLO ANALYSIS OF 1L OATLY BARISTA AND COW'S MILK AT RETAIL INCLUDING END-OF-LIFE (EOL) PACKAGING, SHOWING THE PERCENTAGE OF MONTE CARLO RUNS IN WHICH ONE PRODUCT HAS A HIGHER IMPACT THAN THE OTHER. FOR EXAMPLE, FOR CLIMATE CHANGE, OATLY BARISTA AT RETAIL IN POLAND HAS A LOWER IMPACT THAN COW'S MILK FOR 100% OF THE 1000 MONTE CARLO SIMULATIONS PERFORMED. ABBREVIATIONS USED: PL = POLAND, IE = IRELAND, FR = FRANCE.

6. Conclusion

A Life Cycle Assessment (LCA) has been performed to compare the environmental performance of Oatly Barista to cow's milk in three sales markets in Europe: France, Ireland and Poland. The functional unit considered for this study is 1 liter of Oatly product (ambient and chilled) and cow's milk at retail, including packaging manufacturing and packaging end of life. The study has been performed and critically reviewed according to ISO 14040/14044/14071 standards for comparative assertions to be disclosed to the public.

The results show that the ambient and chilled Oatly Barista in all markets have a lower impact than cow's milk for the impact categories climate change, fine particulate matter formation, terrestrial acidification, freshwater eutrophication, marine eutrophication, land occupation and water consumption. For land use, Oatly Barista also has a lower impact, though the impact is comparable for the chilled version on the Irish market.

For fossil resource scarcity, Oatly Barista has a higher impact than cow's milk for the French market, and comparable to lower impact in the remaining markets. The relatively high fossil resource scarcity impact for Oatly Barista is related to the use of (fossil-based) thermal energy for processing at the Vlissingen factory and the higher use of fuels for distribution. Processing of cow's milk requires less heat, and less transport as it is produced locally. For mineral resource scarcity, Oatly Barista has a higher impact than cow's milk for the Irish market, a comparable impact (in case of the ambient version) or lower impact (in case of the chilled version) for the French market, and a lower impact for the Polish market. The relatively high impact of Oatly Barista in the mineral resource scarcity impact category can be explained by the use of aluminium in the ambient beverage carton, as well as the use of minerals in the generation of renewable energy (wind turbines) used at the Oatly factories. Irish cow's milk has a relatively low impact for mineral resource scarcity due to the relatively high share of grass in the cows' diets (which requires relatively fewer inputs in terms of mineral fertilizers compared to compound feed) as well as due to the use of a plastic bottle as packaging.

The significance of the differences has been determined by an uncertainty analysis. In the main report additional sensitivity analyses were carried out (see section 5.2 of the main report), of which the conclusions also apply to the current products, as they are of similar or relatively lower impact than the Oatly Barista in the main report. The main report concluded that using a different impact assessment method (ReCiPe endpoint, EF3.0 single score[7]) confirmed the overall higher environmental footprint of cow's milk compared to Oatly products for all countries in scope. It also showed that results in the impact categories land use, mineral resource scarcity and water impact categories are less robust, as they result in different trends when using a different impact assessment method (EF 3.0). Furthermore, the sensitivity analyses in the main report concluded that using different product characteristics (inclusion of use stage, using economic allocation for cow's milk, functional unit based on nutritional characteristics), did not lead to different conclusions on the environmental footprint of Oatly products compared to cow's milk.

A detailed analysis of the main drivers and opportunities linked to the environmental impact of Oatly products can be found in the main report. It should be noted that the Vlissingen factory has switched to electricity from wind instead of hydropower, which has resulted in a lower impact of the processing stage for the climate change, mineral resource scarcity and water consumption categories.

Conclusions and recommendations presented here are subject to the assumptions and limitations addressed in this report and the main report. Any comparative assessment intended to be disclosed to the public, should transparently refer to the conclusions of these studies, and be accompanied by the critical review statement.

[7] EF 3.0 is the environmental impact assessment method from the European Commission's Product Environmental Footprint (PEF) method

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Appendix I Oatly production modelling (Confidential)

This appendix is not available in this version of the report due to confidential data.

Appendix II Oatly production modelling (Non-confidential)

Life cycle stage	Description of data	Data quality
1a. Oat cultivation	Modelled using oat cultivation datasets from Agri-Footprint 6. Agri-footprint datasets consider cultivation-related inputs and resources (yield, water consumption, land occupation/ transformation, input of manure, fertilizers, lime, pesticides, start material, energy and transport of inputs), as well as emissions related to the use of these inputs and resources (nitrous oxide, ammonia, nitrate, nitric oxide, carbon dioxide, phosphorus, pesticide, heavy metals). Emissions from land use change and peat oxidation are included as well. The sourcing countries for the factories are listed below, including the yields for oat cultivation as used in Agri-footprint (these are based on FAO statistics; more information on data used can be found in the publicly available Agri-footprint 6 Methodology Report, Part 2 – Data). • Landskrona factory SE: oats from Sweden (yield of 4054 kg/ha) • Vlissingen factory NL: oats from Sweden (yield of 4054 kg/ha), Finland (yield of 3386 kg/ha) and the UK (yield of 5653 kg/ha)	*Good*
1b. Other ingredient production	The quantity of other ingredients used during processing or added to the final product are provided by Oatly. These include enzymes, calcium carbonate, vitamins, salt, and rapeseed oil. Rapeseed oil and a proxy for vitamins was derived from the Agri-footprint database, whereas the other ingredients were modelled using datasets from ecoinvent 3.9.	*Good*
2. Oats transport to mill	To account for transport from oat cultivation to mills, estimates are provided by Oatly (as location of farmers is not available). • Oats destined for Vlissingen factory: An estimate of 300km is assumed for the transportation between the oat fields and the ports. We assume diesel trucks from the oat fields to the port, and a consecutive transportation from the port to the mill in Belgium by sea and diesel trucks. • Oats destined for Landskrona factory: An estimate of 300km is assumed for the transportation between the Swedish oat fields to the mills in Sweden using diesel trucks. All trucks are modelled with a capacity >20t, a load factor of 80% and an empty return.	*Fair*
3. Oats milling	Primary data was provided by Oatly on energy use (electricity and heat), and water consumption for the 2 mills in Sweden, 1 mill in Denmark. The oat hulls are going to either animal feed or biogas production. In two Swedish mills, they are used to generate heat for the milling process. For one of the Swedish mills, no information on energy use was available. An estimate was made by assuming the same energy requirements as for the other Swedish mill, but assuming fossil-based energy sources as a conservative assumption for heat. Public information was available for the electricity source in their sustainability report.	*Good*
4a. Transport of oats to factory	Distance based on locations of the mills and the Oatly factory. Transport was modelled using diesel trucks.	*Very good*
5. Processing – oat base	The input use (energy, heat, water) to generate oat base and finished product was provided by Oatly based on data from the production facilities in scope. Water use includes both water in the recipe (final product), and water used for processing (mainly cleaning). The quantity of water going to wastewater treatment is also recorded.	*Very good*

6. processing – Oatly Barista	The input use (energy, heat, water) to generate oat base and finished product was provided by Oatly based on data from the production facilities in scope. Water use includes both water in the recipe (final product), and water used for processing (mainly cleaning). The quantity of water going to wastewater treatment is also recorded. To account for losses during processing, an estimation was provided by Oatly of 5% losses during the production. This concerns a maximum and is based on an interview with Oatly's factory controller (Veljanovski, 2022).	*Very good*
7a. packaging	Primary data on packaging composition is supplied by the packaging manufacturer. Next to the materials used (such as LDPE, aluminum, paperboard), energy was accounted for processing these materials based on ecoinvent datasets (sheet rolling for aluminum, injection moulding for the HDPE cap etc). BioPE is used in all beverage cartons used by Oatly. It is generated with sugarcane cultivated in Brazil. A BioPE dataset has been calculated by Quantis (Quantis, 2022) and its climate change impact is slightly higher than regular PE (excl LUC). Land use change was added from Blonk's LUC database to account for the risk of deforestation attributed to sugar cane cultivation in Brazil. Secondary packaging (corrugated board) is also included.	*Very good*
7b. Transport of packaging material	Upstream data for packaging (e.g. of raw materials) is already included in the ecoinvent datasets used. Transport (assuming diesel trucks) was added from the packaging manufacturing facilities to Oatly's corresponding factories based on their locations.	*Very good*
8a. Distribution to DC	The transport from the factory to the distribution center is provided by Oatly. Oatly uses trucks with a capacity of 21.5-36 tons (Månsson, 2022) (modelled as >20ton trucks with a load factor of 80%). For chilled distribution, refrigerated truck transport was modelled based on ecoinvent datasets for refrigerated transport. Since ecoinvent only included a small refrigerated transport option (truck < 16 ton), transport for a >20 ton truck was modelled using the same assumptions as for the smaller trucks: 20% higher fuel use for the refrigeration machine, and the use and emission of 1.71E-5 kg R134/tkm.	*Good*
8b. Distribution to Retail	Transport data is provided by Oatly. An additional 50 km of last mile distribution was added.	*Fair*
9. Storage at DC and retail	For European countries, this is based on defaults for ambient storage provided by the PEFCR, with storage duration provided by the Dairy PEFCR (section 6.4): • 1 week of storage at DC (assuming 3x storage volume) • 3 days chilled storage at retail (HTST) • 14 days ambient storage at retail (UHT) Loss rates at retail were provided by Oatly.	*Fair-Poor*
10. End of Life of Packaging	The EoL of the packaging material is calculated using the Circular Footprint Formula (CFF) from the PEFCR. The CFF is only applied for primary packaging materials, using country-specific parameters as provided in Annex C of the PEFCR. The CFF annex provides recycling rates for liquid packaging board as a whole. It is assumed that only the paper part of the beverage carton can be recycled (into pulp). All of the plastic and aluminum is assumed to be incinerated and/or landfilled (Kremser et al., 2022; Thoden van Velzen & Smeding, 2022), using country-specific incineration/landfill rates. For secondary packaging material (corrugated board) no CFF was applied, and dataset was selected that already includes recycled material.	*Fair*

Appendix III Dairy datasets

The datasets for raw milk have been derived from Agri-footprint 6.3. The dairy datasets available in Agri-footprint were originally developed during the Environmental Footprint (EF 3.0) (European Commission, 2022) agro-food database development (2021), and most of the datasets were developed in partnership with the European Dairy Association (EDA). This was done through involving country specific experts reviewing datapoints and providing alternative sources to improve the representativeness of the dataset.

Below a summary is provided of the data used for Polish, Irish and French dairy systems, as derived from the Agri-footprint methodology document. Table A below lists the data sources used.

TABLE A: DATA SOURCES FOR DAIRY FARM PARAMETERS

Parameter	*Country*	*Source*
Milk yield and characteristics	PL	(UNFCCC, 2021)
	FR	(Thomas and Bourrigan, 2019)
	IE	(CSO, 2021)
Animal mortality	PL	(FAO, 2018c)
	IE, FR	(Wageningen UR, 2021b)
Herd composition and sold animals	PL	(FAO, 2018c; UNFCCC, 2021)
	FR	(Thomas and Bourrigan, 2019)
	IE	(Dillon et al., 2021; ICBF, 2021)
Feed intakes	FR, PL	(Leip, 2017)
	IE	(Dillon et al., 2021)
Bedding materials	FR, PL	(Wageningen UR, 2021b)
	IE	(Dillon et al., 2021)
Water use	PL	(Wageningen UR, 2021b)
	FR	(Menard et al., 2012)
	IE	(Murphy et al., 2017)
Energy use	FR, PL	(Wageningen UR, 2021b)
	IE	(Upton et al., 2013)
Time spent on pasture and manure management system	IE, PL	(UNFCCC, 2021)
	FR	(IDELE, 2021; INOSYS Réseaux d'Elevage, 2021)
Compound feed formulation	FR, IE, PL	(Leip, 2017)

The herd at the farm consists of dairy cows, and replacement animals (calves < 1 year, calves 1-2 years and heifers). In most cases, for comparability or data gaps, 100 dairy cows was used as a reference value. The amount of the replacement animals is dependent on the dairy cows replacement rates, various animal mortalities, age of calving and age of slaughtering. The dairy herd composition can be seen in Table B.

TABLE B: HERD SIZE AT VARIOUS COUNTRY DAIRY FARMS, AND OTHER HERD DYNAMICS PARAMETERS.

Herd size and dynamics	*FR*	*IE*	*PL*
Female Calves < 1 yr	40	38	38
Female Calves 1-2 yr	37	35	35
Heifers	18	10	10
Dairy cows	100	82	100
Dairy cows replacement rate (%)	30	21	32
Dairy cows mortality (%)	2.0	2.0	4.0
Dairy cows average weight mortality (kg)	700	535	540
Heifer mortality (%)	2.0	2.0	4.0
Heifers average weight mortality (kg)	587	455	500
Calves 1-2 yr mortality (%)	3.0	2.0	4.0
Female Calves 1-2 yr average weight mortality (kg)	412	268	405
Calves <1 yr mortality (%)	8.0	5.0	8.0

Female Calves <1 yr average weight mortality (kg)	229	45	225
Age at first calving (years)	2.5	2.2	2.0
Age at slaughtering (years)	6.0	7.1	6.0

Dairy farms are a multi output systems, where together with milk, also sold animals are leaving the farm. In all cases, part of the dairy cows herd is replaced each year: these cows, that reached the end of their productive life, are typically culled and sent directly to the slaughterhouse. Most of male calves and part of female calves (not needed for replacement) are sold for further rearing or sometimes directly for slaughtering. In some countries, it is also typical to sell part of the grown animals (e.g., grown calves or heifers).

TABLE C: MILK OUTPUT (AND ITS CHARACTERISTICS) AND SOLD ANIMALS AT VARIOUS COUNTRY DAIRY FARMS.

Outputs and characteristics	*FR*	*IE*	*PL*
Milk (kg dairy cow^{-1})	7373	5443	5511
Milk protein content (%)	3.2	3.5	3.2
Milk Fat content (%)	4.0	4.1	4.1
FPCM Milk (kg dairy cow^{-1})	7315	5620	5535
Culled dairy cows (#)	33	16.9	28
Culled dairy cows average weight (kg)	700	535	540
Sold Calves < 1 yr	39	57.7	38.6
Sold Calves < 1 yr average weight (kg)	45	45	45
Sold Calves 1-2 yr	-	-	-
Sold Calves <1-2 yr average weight (kg)	-	-	-
Sold Heifers	-	-	-
Sold Heifers average weight (kg)	-	-	-

Energy consumption at a dairy farm consists of electricity, diesel, and natural gas, see table below for the consumption of electricity and natural gas. The diesel consumption for land management is incorporated in the cultivation and production of roughage. Also, water is used at the dairy farm, both as drinking water and cleaning water. The source of drinking water is commonly groundwater. Irrigation water is considered in the pasture and roughages cultivation inventory. Bedding materials, in the form of wheat straw and saw dust, are considered in dairy cows' housing.

TABLE D: ENERGY CONSUMPTION AND WATER USE AT VARIOUS COUNTRY DAIRY FARMS.

Country	*Electricity*	*Natural Gas*	*Fuel*	*Water*	*Wheat straw*	*Saw dust*
	MJ/dairy cow			**m3/dairy cow**	**kg/dairy cow**	
FR	1362	0	0	50.5	55	125
IE	1629	0	1068	36.0	50	0
PL	1480	0	0	41.8	55	125

The feed intakes of the various countries dairy farms are displayed in the table below. The various animals ration consists of (1) concentrates, also called compound feeds, (2) fresh grass, which animals eat in pastures, (3) farm grown feed, that mostly consists of grass silage and maize silage, and (4) single ingredients, like for instance straw. For calves, the feed ration depends on their age. When calves are very young and stabled, they are usually fed with raw milk directly from the cows.

TABLE E: DRY MATTER INTAKE (DMI, KG/ANIMAL/YEAR) OF THE ANIMALS ON THE VARIOUS COUNTRIES' DAIRY FARMS PER VARIOUS FEED FED. DRY MATTER (DM, %) CONTENT AND CRUDE PROTEIN (CP, % OF DM) CONTENT OF THE OVERALL DIET.

Type of animal	*Compound feeds intake*	*Fresh grass intake*	*Farm grown feed intake*	*Single ingredients intake*	*Overall diet dry matter content*	*Overall diet crude protein content*
FR	**DMI, kg/animal/year**				**DM, %**	**CP, % of DM**
Calves < 1 yr	602	55	447	0	41.4	17.1
Calves 1-2 yr	166	1970	2293	0	25.4	20.6
Dairy cows	1885	634	4850	557	41.2	16.8
Heifers	166	1970	2293	0	25.4	20.6

IE	DMI, kg/animal/year				DM, %	CP, % of DM
Calves < 1 yr	333	487	320	0	23.9	16.2
Calves 1-2 yr	182	1339	814	0	19.2	16.2
Dairy cows	1026	2797	1144	23	21.1	16.3
Heifers	182	1339	814	0	19.2	16.2
PL	DMI, kg/animal/year				DM, %	CP, % of DM
Calves < 1 yr	893	47	104	0	63.1	14.5
Calves 1-2 yr	479	2187	827	0	24.6	20.3
Dairy cows	2842	762	1034	604	42.6	15.0
Heifers	479	2187	827	0	24.6	20.3

Calculated emissions are CH_4 from enteric fermentation and various manure management related emissions: CH_4, N_2O direct and indirect, NH_3, NO_X, NMVOC and $PM_{2.5}$. Also, NMVOC emissions from silage feeding are included. All these emissions have been calculated with the APS-footprint tool (Blonk Consultants, 2020a, 2020b).

For each country specific dairy farm, animal-specific manure management shares have been considered (UNFCCC, 2021) accounting for the time share that animals spend outside in the pasture. This has an effect on the ration of excretions dropped in the stable and on the pasture. Days spent on the pasture reflect full 24 hours spent outside.

TABLE F: YEARLY EXCRETION OF NITROGEN, PHOSPHOROUS, MANURE, AND METHANE EMISSION DUE TO ENTERIC FERMENTATION FOR EACH ANIMAL TYPE ON THE AVERAGE DUTCH DAIRY FARM.

Type of animal	*Calves < 1 yr*	*Calves 1-2 yr*	*Dairy cows*	*Heifers*
FR	%	%	%	%
Percentage of time spent outside	30	55	39	55
Solid storage	97	90	58	89
Liquid/Slurry with natural crust	3	10	42	11
IE	%	%	%	%
Percentage of time spent outside	39	58	70	65
Pit storage > 1 month	79	68	94	100
Cattle and Swine deep bedding (>1 month)	21	32	6	0
PL	%	%	%	%
Percentage of time spent outside	12	12	10	12
Solid storage	88	88	88	88
Liquid/Slurry with natural crust	5	5	5	5
Liquid/Slurry without natural crust	6	6	6	6

The feed material compositions of the daily ration have been mostly based on a model shared by (Leip, 2017), where, based on import/export feed ingredients statistics and allocation to various animal types.

Roughage is produced on the dairy farm, with a fraction of the manure which is excreted by the dairy cattle. These are in principle with the same methodology described previously for other types of cultivations.

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Appendix IV Full LCIA Results

Ambient Oatly Barista

Impact category	Unit	Oatly Barista NL - EoL packaging FR ambient (retail)	Oatly Barista NL - EoL packaging IR ambient (retail)	Oatly Barista SE - EoL packaging IR ambient (retail)	Oatly Barista NL - EoL packaging PL ambient (retail)	Oatly Barista SE - EoL packaging PL ambient (retail)
Climate change - incl LUC and peat ox	kg CO2 eq	0.578	0.589	0.456	0.636	0.496
Climate change - excl LUC and peat ox	kg CO2 eq	0.446	0.457	0.351	0.505	0.391
Climate change - only LUC	kg CO2 eq	0.018	0.018	0.022	0.018	0.022
Climate change - only peat ox	kg CO2 eq	0.113	0.113	0.082	0.113	0.082
Stratospheric ozone depletion	kg CFC11 eq	3.02E-06	3.02E-06	2.80E-06	3.03E-06	2.81E-06
Ionizing radiation	kBq Co-60 eq	5.44E-02	3.63E-02	2.69E-02	3.70E-02	3.04E-02
Ozone formation, Human health	kg NOx eq	1.42E-03	1.87E-03	2.14E-03	1.72E-03	1.74E-03
Fine particulate matter formation	kg PM2.5 eq	5.10E-04	6.40E-04	6.73E-04	6.00E-04	5.82E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	1.73E-03	2.17E-03	2.48E-03	2.01E-03	2.08E-03
Terrestrial acidification	kg SO2 eq	1.62E-03	2.05E-03	2.35E-03	1.89E-03	2.02E-03
Freshwater eutrophication	kg P eq	1.45E-04	1.57E-04	1.45E-04	1.99E-04	1.92E-04
Marine eutrophication	kg N eq	6.10E-04	6.20E-04	5.98E-04	6.21E-04	6.00E-04
Terrestrial ecotoxicity	kg 1,4-DCB	1.05E+00	1.00E+00	9.87E-01	1.12E+00	1.11E+00
Freshwater ecotoxicity	kg 1,4-DCB	2.73E-02	2.80E-02	2.73E-02	2.90E-02	2.89E-02
Marine ecotoxicity	kg 1,4-DCB	1.86E-02	1.96E-02	1.94E-02	2.09E-02	2.16E-02
Human carcinogenic toxicity	kg 1,4-DCB	1.63E-02	1.65E-02	1.58E-02	1.88E-02	1.84E-02
Human non-carcinogenic toxicity	kg 1,4-DCB	5.17E-01	5.39E-01	5.04E-01	5.85E-01	5.59E-01
Land use (Total)	m2a crop eq	6.59E-01	6.61E-01	6.57E-01	6.61E-01	6.57E-01
Land use (Transformation)	m2a crop eq	8.20E-04	8.11E-04	4.37E-04	1.18E-03	6.08E-04
Mineral resource scarcity	kg Cu eq	1.24E-03	1.23E-03	1.16E-03	1.23E-03	1.18E-03
Fossil resource scarcity	kg oil eq	1.25E-01	1.32E-01	8.14E-02	1.45E-01	9.14E-02
Water consumption	m3	4.11E-03	4.01E-03	3.23E-03	4.97E-03	4.31E-03
Land occupation	m2a	7.45E-01	7.49E-01	7.46E-01	7.49E-01	7.47E-01

Chilled Oatly Barista

Impact category	Unit	Oatly Barista NL - EoL packaging FR chilled (retail)	Oatly Barista NL - EoL packaging IR chilled (retail)	Oatly Barista SE - EoL packaging IR chilled (retail)	Oatly Barista SE - EoL packaging PL chilled (retail)	Oatly Barista NL - EoL packaging PL chilled (retail)
Climate change - incl LUC and peat ox	kg CO2 eq	0.609	0.625	0.493	0.556	0.699
Climate change - excl LUC and peat ox	kg CO2 eq	0.472	0.489	0.387	0.449	0.562
Climate change - only LUC	kg CO2 eq	0.024	0.024	0.024	0.024	0.024
Climate change - only peat ox	kg CO2 eq	0.113	0.113	0.083	0.083	0.113
Stratospheric ozone depletion	kg CFC11 eq	3.06E-06	3.07E-06	2.84E-06	2.85E-06	3.09E-06
Ionizing radiation	kBq Co-60 eq	5.86E-02	3.63E-02	2.74E-02	3.09E-02	3.71E-02
Ozone formation, Human health	kg NOx eq	1.49E-03	2.11E-03	2.47E-03	1.93E-03	1.85E-03
Fine particulate matter formation	kg PM2.5 eq	4.94E-04	6.76E-04	7.34E-04	6.09E-04	6.12E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	1.78E-03	2.41E-03	2.81E-03	2.26E-03	2.15E-03
Terrestrial acidification	kg SO2 eq	1.60E-03	2.12E-03	2.46E-03	2.10E-03	1.96E-03
Freshwater eutrophication	kg P eq	1.40E-04	1.53E-04	1.42E-04	2.01E-04	2.07E-04
Marine eutrophication	kg N eq	6.11E-04	6.20E-04	5.98E-04	6.01E-04	6.22E-04
Terrestrial ecotoxicity	kg 1,4-DCB	1.05E+00	1.02E+00	9.93E-01	1.11E+00	1.13E+00
Freshwater ecotoxicity	kg 1,4-DCB	2.62E-02	2.73E-02	2.69E-02	2.84E-02	2.81E-02
Marine ecotoxicity	kg 1,4-DCB	1.72E-02	1.87E-02	1.90E-02	2.09E-02	1.99E-02
Human carcinogenic toxicity	kg 1,4-DCB	1.24E-02	1.36E-02	1.34E-02	1.58E-02	1.57E-02
Human non-carcinogenic toxicity	kg 1,4-DCB	4.99E-01	5.25E-01	4.96E-01	5.60E-01	5.82E-01
Land use (Total)	m2a crop eq	6.68E-01	6.69E-01	6.61E-01	6.61E-01	6.70E-01
Land use (Transformation)	m2a crop eq	9.86E-04	9.52E-04	5.21E-04	7.69E-04	1.42E-03
Mineral resource scarcity	kg Cu eq	1.01E-03	1.04E-03	9.96E-04	9.64E-04	1.00E-03
Fossil resource scarcity	kg oil eq	1.23E-01	1.34E-01	8.71E-02	9.71E-02	1.48E-01
Water consumption	m3	4.21E-03	4.09E-03	3.31E-03	4.72E-03	5.39E-03
Land occupation	m2a	7.53E-01	7.58E-01	7.51E-01	7.52E-01	7.59E-01

Appendix V Nutritional composition of Oatly Barista and cow's milk

Nutritional data is provided for whole cow's milk for the countries in scope. All values are provided per 100 ml.

		Oatly Barista	Cow's milk		
	Unit	EU	Poland	Ireland	France
Energy	kJ	257.0	279	265	236
	kcal	61.0	67	63	56.5
Fat	g	3.0	3.9	3.6	3.3
of which saturated	g	0.3	2.3	2.3	2.16
essential fatty acids	g	0.8	Not reported	Not reported	Not reported
Carbohydrates	g	7.1	4.8	4.6	3.47
of which sugars	g	3.4	4.8	4.6	3.2
Fiber	g	0.8	0	0	0
Protein	g	1.1	3.1	3.4	3.3
Sodium	mg	0.0	45	42	79
Vitamin D	µg	1.1	0.02	0	0.1
Riboflavin	mg	0.2	0.17	0.23	Not reported
Vitamin B12	µg	0.4	0.40	0.9	0.32
Calcium	mg	120.0	120	120	117
Iodine	µg	22.5	3.0	31	24.3
Iron	mg	not reported	0.1	0.02	0.04
Potassium	mg	not reported	141	157	140
Vitamin A	µg	not reported	25	Not reported	Not reported
Phosphorus	mg	not reported	86	96	93

Source Oatly: https://www.oatly.com/en-gb/products/oat-drink/oat-drink-barista-edition-1l

Source Poland: https://www.environmed.pl/pdf-159379-86700?filename=Cows%20milk%20_%20a%20simple%20and.pdf

Source Ireland: https://ndc.ie/the-nutritional-composition-of-dairy/

Source France: https://ciqual.anses.fr/#/aliments/19024/milk-whole-pasteurised

Appendix VI Critical Review Statement and Report

Critical Review Statement

The life cycle assessment (LCA) study *LCA of Oatly Barista for Poland, Ireland and France, and comparison with cow's milk* addendum to the report *"LCA of Oatly Barista and comparison with cow's milk"* was commissioned by Oatly (commissioner of the study) and carried out by Blonk Consultants (practitioner of the LCA study). Blonk Consultants commissioned a panel of external experts to review the study *LCA of Oatly Barista for Poland, Ireland and France, and comparison with cow's milk*. The study was critically reviewed by an international panel of experts comprising:

- Jasmina Burek (chair): Assistant Professor, University of Massachusetts Lowell, United States
- Jens Lansche: LCA expert and project manager, Switzerland
- Joseph Poore: Director of the Oxford Martin Programme on Food Sustainability, United Kingdom
- Hayo van der Werf: LCA expert, France

All members of the review panel were independent of any party with a commercial interest in the study. The following is a final statement by the external review panel based on the review of the Draft Report, a version of the document submitted on April 29, 2024.

Critical Review Process

The critical review was performed based on ISO 14044:2006 standard, by a panel of interested parties (ISO 14044, 2006). The critical review panel followed the ISO/TS critical review process guidelines (ISO/TS, 2014). The panel performed the critical review at the end of the LCA study, after LCA practitioners provided the full draft of the LCA report. This is because this study closely follows methods of previously peer reviewed report "LCA of Oatly Barista and comparison with cow's milk", by the same expert panel. Two subsequent sets of review comments were performed after LCA practitioners provided the full draft of the LCA report to the critical review panel. The reviewers took part in communication via email. The critical review report (Appendix VI) includes panel review comments and recommendations and the corresponding responses given by the practitioner of the LCA study.

The critical review panel found the LCA study to be in conformance with ISO 14040 and ISO 14044 standards (ISO 14040, 2006; ISO 14044, 2006) including:

- the methods used to carry out the LCA were consistent with the applicable international standards
- the methods used to carry out the LCA were scientifically and technically valid
- the data used were appropriate and reasonable in relation to the goal of the study
- the interpretations reflected the limitations identified and the goal of the study, and
- the study report was transparent and consistent.

The critical review did not verify nor validate the goals that are chosen for an LCA by the commissioner of the LCA study, nor the ways in which the LCA results are used (ISO/TS, 2014). Finally, following the ISO/TS standard (ISO/TS, 2014) this critical review in no way implies an endorsement of any comparative assertion that is based on an LCA study. The panel asserts conformity with the ISO standards followed (ISO 14040, 2006; ISO 14044, 2006; ISO/TS, 2014) and a scientifically and technically valid methodological approach and results interpretation.

The critical-review process involved the following:

- a review of a draft report according to the above criteria and recommendations for improvements to the study and the report; and
- a review of the final version of the report, in which the authors of the study fully addressed the points as suggested in the draft critical review.

Because the *LCA of Oatly Barista for Poland, Ireland and France, and comparison with cow's milk* study builds on the foundations of the previous LCA studies study for Oatly, i.e., "*LCA of Oatly Barista and comparison with cow's milk"*, reviewed by the same external review panel, all reviewers' comments were provided via email including:

- April 5, 2024 – reviewers provided comments on the draft of the final LCA report via email.
- April 26, 2024 - reviewers validated changes from the previous review and identified minor editorial changes on the final LCA report via email.

After each review, the LCA practitioner responded and/or and documented the adopted changes and implementation in the next version of the draft report. The Critical Review Report (Appendix VI) includes panel review comments and recommendations and the corresponding responses given by the practitioner of the LCA study.

The review panel concludes based on the goals set forth to review this study, that the study generally conforms to the applicable ISO standards as a comprehensive study that may be disclosed to the public.

The reviewers recognize the tremendous work of the LCA practitioners and stakeholder in completing this study.

April 29, 2024

Dr. Jasmina Burek	Dr. Jens Lansche	Dr. Joseph Poore	Dr. Hayo van der Werf
Panel Chair	Panel Member	Panel Member	Panel Member

LCA of Oatly Barista for Poland, Ireland and France, and comparison with cow's milk

Addendum to the report "LCA of Oatly Barista and comparison with cow's milk", published on 7 December 2022

Version of the document submitted on April 29, 2024

Critical Review Report

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1. Introduction

The **Critical Review Report** is the summary report documenting the critical review process according to the ISO/TS 14071:2014 Standard - Environmental management -- Life cycle assessment -- Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006. The **Critical Review Report** provides details of the complete review process (ISO/TS, 2014) and includes all review comment iterations of the study "*LCA of Oatly Barista for Poland, Ireland and France, and comparison with cow's milk*", which is addendum to the report *"LCA of Oatly Barista and comparison with cow's milk"*. The study "*LCA of Oatly Barista for Poland, Ireland and France, and comparison with cow's milk*" was commissioned by Oatly and life cycle assessment (LCA) was performed by Blonk Consultants. The critical review was commissioned by the practitioners of the LCA study. Critical review was carried out by a panel of reviewers, as defined in ISO 14044:2006 (ISO 14044, 2006). The **Critical Review Report** was prepared by the critical review panel. The **Critical Review Report** applies to the final version *"LCA of Oatly Barista for Poland, Ireland and France, and comparison with cow's milk"*, published on April 29, 2024.

2. Critical Review Process

The critical review panel followed the ISO/TS critical review process guidelines (ISO/TS, 2014). Because this LCA study includes results which are intended to be used to support a comparative assertion intended to be disclosed to the public, per critical review process guidelines (ISO/TS, 2014), the critical review was conducted by a panel.

Two sets of reviewer comments were provided after LCA practitioners provided the full draft of the LCA report to the critical review panel. The critical review report includes panel review comments and recommendations, and the corresponding responses given by the practitioner of the LCA study.

Per critical review process guidelines (ISO/TS, 2014), the goal of this critical review was to verify that:

- the methods used to carry out the LCA study are consistent with the 14040/14044 International Standards (ISO 14040, 2006; ISO 14044, 2006),
- the methods used to carry out the LCA are scientifically and technically valid,
- the data used are appropriate and reasonable in relation to the goal of the study,
- the interpretations reflect the limitations identified and the goal of the study,
- the study report is transparent and consistent.

However, critical review can neither verify nor validate the goals that are chosen for an LCA by the commissioner of the LCA study, nor the ways in which the LCA results are used (ISO/TS, 2014). Finally, following the ISO/TS standard (ISO/TS, 2014) this critical review in no way implies an endorsement of any comparative assertion that is based on an LCA study.

The review was performed by an independent expert panel composed of four members. The critical-review process involved the following:

- a review of a draft report according to the above criteria and recommendations for improvements to the study and the report; and
- a review of the final version of the report, in which the authors of the study fully

addressed the points as suggested in the critical review.

3. Critical Review Results

This section includes a summary of the critical review. A complete list of comments addressing specific statements on the draft LCA report provided by the critical review panelists and subsequent revisions is provided in Appendix VI.

The reviewers recognize the remarkable effort by the LCA practitioners (Blonk Consultants) in conducting the comparative LCA study as well as the stakeholder (Oatly) that provided primary data as well as critical comments. The critical review panel pointed out both the strengths as well as key areas of improvement necessary to conform to the 14040/14044 International Standards (ISO 14040, 2006; ISO 14044, 2006).

3.1. Consistency with 14040/14044 International Standards

The final LCA report is consistent with the 14040 and 14044 International Standards (ISO 14040, 2006; ISO 14044, 2006) and the European Product Environmental Footprint Category Rules (PEFCR) (European Commission, 2017). It was not deemed necessary to repeat all sensitivity analyses, considering that the environmental impacts related to Oatly Barista (main report), are comparable to the results of Oatly Barista at point-of-sale Poland, Ireland, and France. Thus, the conclusions that were drawn based on the sensitivity analyses in the main report also apply to the products in this addendum.

The study is comprehensive in scope and contains a wealth of information and data related to Oatly Barista product supply chains in their respective sales countries, i.e., Poland, Ireland, and France. The authors provided information about why the critical review is being undertaken and what data collection covered and to what level of detail and how comparison with the milk was conducted.

3.2. Life Cycle Assessment Approach and Life Cycle Impact Assessment Method

The authors computed results following the attributional LCA approach. In a baseline scenario, Oatly Barista was compared to 1 l of cow milk at the point of sale, i.e., Poland, Ireland, and France. The life cycle impact assessment was performed using ten key midpoint environmental impact categories from the ReCiPe 2016 impact assessment method (Huijbregts et al., 2016). Overall, the methodology to evaluate the results of the impact assessment and support conclusion are considered appropriate for the goal and scope of the study.

3.3. Data Used for Life Cycle Inventory in Relation to the Goal of the Study

The life cycle inventory (LCI) data necessary to perform LCA of Oatly Barista for Poland, Ireland, and France markets was taken from the main Oatly Barista report with exception to (1) energy and water use at the Vlissingen and Landskrona factories was updated to 2022 data, (2) background data have been updated to Agri-footprint 3.6, and Ecoinvent 3.9 LCI databases, (3) country-specific distribution data from the Vlissingen and Landskrona factories to Poland, Ireland and France, for both ambient and chilled versions of Barista was updated to recent year, and (4) Poland, Ireland, and France cow's milk supply chain LCI data was obtained from recent literature and LCI database. The authors of the final report clearly described LCIs and data sources. Also, authors provided information about robustness and limitations of the data used for Oatly Barista and cow's milk LCI and assumptions for sensitivity and uncertainty analyses. Overall, the data used is considered appropriate and reasonable for the goal and scope of the study.

3.4. Interpretation and Limitations within the Goal of the Study

The selected results help to understand the study's conclusions and adequately support derived interpretation. Overall, interpretation of results and limitations of the study discussed in the report are considered appropriate for the goal of the study.

3.5. Transparency and Consistency of the Final Report

The authors provided an addendum report following the 14040/14044 International Standards (ISO 14040, 2006; ISO 14044, 2006) and supplemental information with information concerning the data and methodology used and differences from the main report. The addendum report describes the LCA framework including goal and scope, LCI, LCIA, results and interpretation and conclusion. The key aspects of the data used is described in the LCI section and accompanied with the main Oatly Barista report, which provides more details on the data sources. Overall, the information given in the documentation is considered appropriate for understanding the methodology and data basis for most topics.

Literature

European Commission, 2017. Product Environmental Footprint Category Rules Guidance. PEFCR Guid. Doc. - Guid. Dev. Prod. Environ. Footpr. Categ. Rules (PEFCRs), version 6.3, December 2017. 238.

Huijbregts, M.A.J., Steinmann, Z.J.., Elshout, P.M.F., Stam, G., Verones, F., Vieira, M.D.., Zijp, M., van Zelm, R., 2016. ReCiPe 2016: A harmonized life cycle impact assessment method at midpoint and enpoint level - report 1 : characterization, National Institute for Public Health and the Environment.

ISO/TS, 2014. ISO/TS 14071:2014 - Environmental management -- Life cycle assessment -- Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006 [WWW Document]. URL https://www.iso.org/standard/61103.html (accessed 6.21.19).

ISO 14040, 2006. ISO 14040:2006 - Environmental management - life cycle assessment - principles and framework [WWW Document]. ISO. URL https://www.iso.org/standard/37456.html (accessed 2.22.17).

ISO 14044, 2006. Environmental management - Life cycle assessment — Requirements and guidelines (International Organization for Standardization).

4. List of Specific Reviewer Comments Recommendations and Corresponding Responses

The Critical Review Panel provided comments on 2 iterations of the draft report. These comments were addressed and/or incorporated in the final version of the report by the LCA partitioners. The review statement and review panel report including comments of the experts and any responses to recommendations made by the reviewers or by the panel have been included in the final LCA report.

Date: March 28 2024 – April 29 2024	Document: **LCA of Oatly Barista for Poland, Ireland and France, and comparison with cow's milk**	Project:

Reviewer[1]	Line number	Clause/ Subclause	Paragraph / Figure/ Table/	Type of comment[2]	Comments	Proposed change	Response of the commissioner & practitioner
HW			Tables 1, 2, 7, 8	ed	"green" looks more like blue to me.	Adjust text or colours.	Done
HW			Tables 1, 2, 7, 8	ed	"yellow" is not yellow	Adjust text or colours.	Done
HW			Tables 1, 2, 7, 8	ed	"red" is not really ared.	Adjust text or colours.	Done
HW	118			ed	"land use" is not mentioned here.	Add "land use".	Done
HW	119-120			ed	"land use" should not be mentioned here, and what is said about Fossil resource scarcity is not correct.	Delete this bullet point.	Done
HW	122			ed	The mineral resource scarcity impact is similar (< 10% difference) for the French market.	Adjust text.	Done
HW	122			ed	Add a bullet point on Fossil resource scarcity.	Adjust text.	Done
HW	126			ed	Change "freshwater" to "freshwater eutrophication"	Adjust text.	Done
HW	128-129			ed	Change "Oatly Barista has a lower impact than cow's milk for land use and fossil resource scarcity, though the difference is not significant in some cases." to "Oatly Barista has a lower impact than cow's milk for land use, though the difference is not significant in one case."	Adjust text	Done
HW	123			ed	Add a bullet point on Fossil resource scarcity.	Adjust text.	Done
HW	157			ed	"carried out by the same review panel". The review panel was not identical.	Adjust text.	Done
HW			Table 3	ed	Change "bottel" to "bottle".	Adjust text.	Done
HW	337-338				No need for this sentence here, since Figure 6 is presented in the next section (5.1.2)		Done
HW	357-392			ed	In these paragraphs it is not indicated to which figures the results described refer.	Can you refer the results to specific figures by inserting figure numbers ?	Done
HW	360-361			ed	Change "in the product" to "for the milk as a raw material"	Adjust text.	Done
HW	367			te	"For French cow's milk the processing impact is lower than for Poland and Ireland due to a higher share of renewable energy in the national electricity mix". Are you certain of this? French	Please check.	Done

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2 **Type of comment: ge** = general **te** = technical **ed** = editorial

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Reviewer[1]	Line number	Clause/ Subclause	Paragraph / Figure/ Table/	Type of comment[2]	Comments	Proposed change	Response of the commissioner & practitioner
					electricity is not particularly high in renewable energy, it is high in nuclear energy.		
HW	428-431			te	The difference between the climate change impact of the French and Irish milk versus the Polish milk is quite important. Since the raw milk is the reference to which Oatly Barista is compared, I think it would be good to push this comparison a bit further. Is the difference really due to the share of compound feed, only to this? In the initial December 2022 report a detailed description is given of the milk production systems for Sweden, Finland, and the United states is given. I think it would be good to present the main characteristics of the milk production systems in an appendix, to better document them to help understand the differences in climate change impact.	Add information on the three milk production systms.	Done, added appendix with data used for dairy systems and further explained differences in text.
HW	440			ed	Change "allocation" to "allocation method".	Adjust text.	Done
HW	484			ed	Change "ambient" to "ambient and chilled"	Adjust text.	Done
HW	485			ed	Change "but not significantly lower in case of" to "except for"	Adjust text.	Done
HW	486			ed	"yet not significant in a number of cases". I do not see where the difference is not significant.	Adjust text.	Done
HW			Fig. 9	ed	For "Ireland" titles of the left and right panels are identical, i.e. we have twice "Oatly Barista SE – IE ambient and cow's milk IE at retail", one of these must be "Oatly Barista NL – IE ambient and cow's milk IE at retail". We also have twice "Oatly Barista SE – IE chilled and cow's milk IE at retail", one of these must be "Oatly Barista NL – IE chilled and cow's milk IE at retail"….	Adjust text.	Done
HW	508				Change "for the Irish market" to "for the chilled version on the Irish market"		Done.
JP				ge	Oatly have – for a long time – labelled their products with their climate impacts. I recognise this labelling work was was done by a different organisation, but for me, as a reader of this report, I expect at least some basic reconciliation to these old numbers. What has changed and why?	Add text or data which provides a reconciliation to prior claims made for these products.	Done
JP	53		Table 1	ge	The columns are labelled with the impact <u>categories</u> (e.g., "climate change", "land use"). Impact categories are broad areas	Rename the columns to include the indicator name. For me this is a particularly	Done, table with impact categories and corresponding indicators added in Section 2.

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Template for CR comments and commissioner & practitioner responses

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Reviewer[1]	Line number	Clause/ Subclause	Paragraph / Figure/ Table/	Type of comment[2]	Comments	Proposed change	Response of the commissioner & practitioner
					which can contain one or more indicators. However, the indicator used is not specified in the table. The only way you could know what the indicator is to work backwards from the units. E.g., the "land use" category indicator is "agricultural land occupation potential" – but the only way to currently know that is to go into the ReCiPe documentation and check against the units or go ahead to line 238 of the text where this is caveated for the land indicator only. Water use is actually – I think – "water consumption potential" (which is the ReCiPe indicator), but a typical reader could not know that. A typical reader could easily think that the category names are in fact indicator names.	strong issue for the columns "land use" and "water consumption", and I would be ok if you just renamed these columns and footnoted the others instead. They should also be changed throughout in the text.	
JP	53		Table 1	ge	Having two land indicators in this table is confusing. I think an uncharacterised indicator is fine, but the characterised indicator is not. Specifically a typical reader would not understand that the ReCiPe indicator is calculated by multiplying the pasture land area in the dairy data by a factor which represents the global difference between biodiversity in cropland and biodiversity in pasture. This is a confusing indicator to understand and take anything meaningful from. In general, I would generally challenge the use of this ReCiPe indicator anyway: the data it is based on are old (specifically an old version of the GLOBIO model), the idea that you can have a single global characterisation factor for the biodiversity difference between cropland and pasture is very debatable – biodiversity varies substantially by geography for example; and finally the way the ReCiPe model treats land transformation is bases on a lot of assumptions. To summarise, the ReCiPe land model is a very old, assumption laden model, making a very spurious characterisation. This is worsened by confusing presentation in the table which presents it as a land use indicator when in fact it is a characterised indicator based on global biodiversity loss.	Remove ReCiPe "land use" from Table 1	After discussion agreed to leave land use indicator in current addendum to remain consistent with the main report. Further explanations of the indicators used was added in chapter 2.
JP	122			ed	Should read "significantly"	Adjust text.	Done
JP	122			ed	In general, "significantly" should mean statistically significant at a defined p value. I would use the word "substantially" instead of significantly.	Adjust text.	The significance is substantiated by an uncertainty analysis
JP	122			ed	Should read "significantly"	Adjust text throughout.	Done
JP	152			ed	Missing comma after and	Adjust text.	Done
JP	202			ed	"Data" are normally plural.	Change to "data are" throughout.	Done

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Reviewer[1]	Line number	Clause/ Subclause	Paragraph / Figure/ Table/	Type of comment[2]	Comments	Proposed change	Response of the commissioner & practitioner
JP	207			ed	"Data" are normally plural.	Change to "data have" throughout.	Done
JP	205			ed	The meaning of "(semi-)skimmed" is unclear.	Either say "semi-skimmed and skimmed" or say "semi-skimmed or skimmed".	Done
JP	211		Table 4	te	The 50:50 split between semi and skimmed milk seems quite different to the only case where you have real data – France. Can you justify this assumption better?	Justify assumption.	Indeed if you look at European data semi-skimmed milk is generally more common than skimmed. However, due to lack of data this 'safe' assumption has been made (safe in terms that it benefits the milk as skimmed milk has a lower impact)
JP	237			ed	The "(" should be before 2016 not before "M." i.e., "(see M. A. J. Huijbregts, Steinmann, Elshout, & Stam, (2016) for more information)"	Move the "(".	Done
JP	258			ed	Missing full stop at end of sentence.	Adjust text.	Done
JP	283			te	Does the use of "significant" mean a statistical analysis was conducted?	If not, rename to "substantially". If so, provide details of the statistics.	Done
JP	294		Table 5	te	"Land use (Total)" is neither an impact category nor an impact indicator.	I am suggesting deletion of this indicator from tables anyway above.	See discussion in previous comment marked in yellow
JP	294		Table 5	ed	The scientific numbers are confusing. E.g., 7.45E-01. This makes the data difficult to read and complicated for general readers. Further scientific format is used inconsistently (e.g., not on the GHG indicator but on the land indicator).	Remove the "scientific" format. Either write numbers like 7.45E-01 as 0.745. Or change the units from kilograms to grams, multiply by 1000 and write the numbers normally.	Done
JP	294		Table 5	ge	Seems to be two columns of data missing from this table.	Check the table or delete the empty columns for clarity.	This is correct; the Oatly Barista available in France is only sourced from the Vlissingen factory, not from the Landskrona factory.
JP	294		Table 5	ge	The percentage difference comparison for cows milk comes after the data. This is confusing. Normally it goes: data point x, data point y, comparison x vs y.	Move cows milk to the start of the table.	Done
JP			Fig. 5	te	The land occupation related to packaging looks high.	It would be good to provide the activity data and calculation here (e.g., 0.05kg cardboard per L milk * 5m2a/kg cardboard).	Clarified in text that this is due to the impact of cartonboard (and forestland, where wood is obtained from, is differently characterised in land use indicator than land occupation indicator (where it is uncharacterised))
JP			Fig. 5	te	The water use in the storage stage of the Polish system looks high.	Consider sense checking these numbers.	This is because high water use related to electricity generated from hard coal and lignite. It is already mentioned in the text that these electricity types have

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Reviewer[1]	Line number	Clause/ Subclause	Paragraph / Figure/ Table/	Type of comment[2]	Comments	Proposed change	Response of the commissioner & practitioner
							a higher impact for several impact categories, amongst which water.
JP			Fig. 6	ge	The figure caption mentions cow's milk, but there is no cow's milk data in the figure. It would be most useful to have it in this table as there is only data for raw cows milk provided (i.e., without processing etc.)	Adjust caption text or add cows milk data.	Done
JP			Fig. 8	te	Your definition of a confidence interval is incorrect. You state "95% confidence interval; meaning that 95% of the results lay within this range". It should read "if we were to take 100 different samples and compute a 95% confidence interval for each sample, then approximately 95 of the 100 confidence intervals will contain the true mean value." You can get simpler definitions online.	Change the definition of a confidence interval.	Done
JP	461			te	The Monte Carlo results are only as good as the parameters you put in. E.g., if you have a standard deviation on your fuel use data, but didn't add one to your processing conversion data, your resulting error will be too low as you missed some standard deviations in your activity data. I suspect that is why your 95% CIs from the Monte-Carlo look so narrow.	Better state the limits of Monte Carlo.	Done
JP	525			te	I cant see the value to this report of stating that under EF 3.0 you got different results. Why is this the case? What is EF 3.0? What is the exact method behind it and why is it giving this result?	Either provide detail on EF calculations, or delete this text as it is just confusing.	Done. Reference is made to the sensitivity analyses section in the main report where further information can be found, and a footnote is added what EF means.
JP	646			te	I cannot work out why the GHG emissions from the processing oat base stage are so much higher in the NL vs SE case, yet the activity data looks fairly similar? Possibly it is actually the transport that is different – if so this isnt really processing.	Check the processing emissions for NL, and clarify the Fig. 6 data if needed.	In 5.1.1. it is mentioned that the higher impact is caused by the use of natural gas in the Vlissingen factory, but it wasn't mentioned that biogas is used in the Landskrona factory. Now added this.
JP	646			te	What does this text mean in the table? "Based on Blonk inland transport distance for Sweden. Includes transport of enzymes from previous stage"? How can "sea" have "inland transport" distance? And what is being transported where?	Clarify text in table.	It refers to Blonk's transport model, which is further explained in section 5.1.3 of AFP methodology doc – part 2 (data). It should read national transport distances instead of inland, this is now changed in the text.
JP	657			ed	Double space between "Sea" and "(km)" and "Road" and "(km)".	Adjust text.	Done

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JP	657			ge	What does "13+29" mean in this table?	Clarify text.	This means that there is twice road transport (before and after sea transport)
JP	657			ge	It is hard to check these data without knowing what they are.	Provide more information on what these data represent.	Done
JP				ge	There is no activity data or emissions inventory for the cow's milk. Without this, I cannot critically review the results. I had a look in the main report, but could only see dairy data for different markets.	Add this to the document, or share it with me separately, so I can critically review it.	Dairy data added as Appendix II (copied from Agri-footprint methodology document which is publicly available)
JP				ge	There is no activity data or emissions inventory for the oat production. Without this, I also cannot critically review the results.	Add this to the document, or share it with me separately, so I can critically review it.	Oat inventory data was shared with the reviewers, and an appendix was added detailing which data was used per life cycle stage.
JP				ge	There is some deforestation showing for Oatly's products in the CO2 LUC numbers – do they purchase inputs with deforestation – if so, it is correct to reflect this; if not, it should be checked.	Check the data (and directly with the client if needed).	The LUC impact is mainly related to the Bio-PE used in Oatly's beverage cartons, which has a relatively high climate change impact due to LUC impact associated with sugarcane cultivation in Brazil (this was also mentioned in section 5.1.1). Oatly does have Bonsucro certification, but since current LCA guidelines don't provide clarity on how to treat such mass-balance-based certificates, a conservative approach has been taken here.
JL				ed	The year at the bottom of the page does not correspond to the year of publication	Change "2023" to "2024"	Done
JL			Tables 1, 2, 7, 8	ed	The colours do not correspond particularly well to their description: "red" looks more like orange, "yellow" like pink		Done
JL	100			ed	"are" doesn't make sense to me in this sentence	Remove "are"	Done
JL	119			te	Fossil resource scarcity is higher for FR which is currently not mentioned in the text	Be more specific about fossil resource scarcity in FR	Done
JL	126			ed	It should read "freshwater eutrophication"	Add "eutrophication"	Done
JL	128			te	Fossil resource scarcity is higher for FR which is currently not mentioned in the text	Be more specific about fossil resource scarcity in FR	Done
JL	152/153			ed	The text refers to ecoinvent 3.9 as the latest version of the db which is not correct. Ecoinvent 3.10 was released in November 2023	Remove "latest version" for ecoinvent	Done

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Reviewer[1]	Line number	Clause/ Subclause	Paragraph / Figure/ Table/	Type of comment[2]	Comments	Proposed change	Response of the commissioner & practitioner
JL	157			ed	It is stated that the critical review was "carried out by the same review panel as for the main report". This is only partially correct. Joseph Poore joined the panel and replaced Joanna Trewern.	Mention the changes in the review panel.	Done
JL			Table 3	ed		Adjust the column width of the first column, which is displayed with "reference" in a line	Done
JL			Table 3	ed	"bottel" should read "bottle"	Correct text	Done
JL			Figure 5	ed	It looks like there is a "credit" (negative value) for EoL packaging for fossil resource scarcity of Cow's milk IE which is not mentioned in the text.	Add an explanation	Done
JL	420				It is stated that "Cow's milk represents an average cow's milk product at retail for each country" but the figure does not contain information about cow's milk,	Remove the sentence	Done
JL			Appendix	te	What I miss is a description of the milk production systems in Poland, Ireland and France in one of the Appendices. I would assume these can be substantially different from the ones in the main report. They are also different from one another, which is partly discussed in the text. Nevertheless, more details in the appendix would be useful.	Add Appendix with a detailed description of the milk production systems in PL, IE and FR.	Done
Comments on revised version (April 26, 2024)							
HW			Table 6	ed	In the column “Impact category”, to be coherent with Table 5 change “Global warming” to Climate change”.	Adjust.	Done
HW			Table 7	ed	In the column “Impact category”, to be coherent with Table 5 change “Global warming” to Climate change”.	Adjust.	Done
HW			Figure 9	ed	In the figure, to be coherent with Table 5 change “Global warming” to Climate change”.	Adjust.	Done
HW			Appendix II , life cycle stage 2	ed	“•Oats destined for Vlissingen factory: An estimate of 300km is assumed for the transportation between the oat fields and the capitals” Given the sentence that follows, it seems that “capitals” should be “port”.	Can you check?	Done
HW			Appendix III, Table A	ed	References listed under “Sources” are not given.	Can you add references?	Done

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Reviewer[1]	Line number	Clause/ Subclause	Paragraph / Figure/ Table/	Type of comment[2]	Comments	Proposed change	Response of the commissioner & practitioner
HW			Appendix IV	ed	In the column "Impact category", to be coherent with Table 5 change "Global warming" to Climate change".	Adjust.	Done
JB	73			ed	,yet this in one case not significant	rephrase	Done
JB	77			ed	market, and comparable to lower impact (6% to 49% lower) in the Polish and Irish markets.	It would be clearer if comparable to milk would be separated from lower than milk.	Done
JB	125			ed	Lower or comparable for the Polish and French market	*Recommend separating lower and comparable for respective markets.	Done
JB	127			ed	is lower or comparable for the Irish and Polish markets	Same as *	Done
JB	134			ed	though the difference is comparable for Oatly Barista from the Vlissingen factory distributed to the Irish market.	Rephrase, the impact is comparable to milk…	Done
JB	140			ed	lower or comparable for the Irish and Polish markets	Same as *	Done
JB	172			ed	climate change results	Should state climate change impact results	Done
JB	173			ed	exactly correspond	"Exactly" is not necessary	Done
JB	180			ed	environmental impact	environmental impacts	Done
JB	180			ed	and in addition compare	and compare	Done
JB	208			ed	but in this report	but in this report,	Done
JB	251			ed	Due to several flaws related to the methodology of this indicator	Add footnote 4 after indicator	Done
JB	304			ed	comparable to lower impact	Same as *	Done
JB	523			ed	For the Oatly Barista, land use, the impact of Oatlly Barista is lower in all cases, but not this is not significant in case of Oatly Barista sold in Ireland.	Add compared to milk and also change significant to comparable?	Done

1 Initials of the **Reviewer**

2 **Type of comment: ge** = general **te** = technical **ed** = editorial

5. Self-declaration of independence

I, the signatory, hereby declare that:

- I am not a full-time or part-time employee of the commissioner or practitioner of the LCA study
- I have not been involved in defining the scope or carrying out any of the work to conduct the LCA study at hand, i.e. I have not been part of the commissioner's or practitioner's project team(s)
- I do not have vested financial, political, or other interests in the outcome of the study

I declare that the above statements are truthful and complete.

Date: April 29, 2024

Name: Dr. Jasmina Burek

Signature:

Name: Dr. Jens Lansche

Signature:

Name: Dr. Joseph Poore

Signature:

Name: Dr. Hayo van der Werf

Signature:

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