

Valio GHG Inventory Report 2023

Part 1: Descriptive information

Descriptive information	Company response
Company name	Valio Ltd
Description of the company	<p>Valio Ltd is a dairy company owned by dairy cooperatives. The company was founded in 1905 by Finnish farmers and currently is a limited liability company owned by 14 dairy cooperatives. Valio has a supply agreement with five cooperatives, which have about 3 500 Finnish milk suppliers as members. Valio is Finland's largest milk processor, producing about 80% of the country's milk. Valio has about 4200 employees working in Finland, Estonia, Sweden, China and the United States (US).</p> <p>Valio Ltd has 12 production plants in Finland and two in Estonia. The production plants focus on consumer dairy products but also plant based products. In addition, about 30-40% of the company revenue comes from industrial and food service items. Valio is Finland's biggest food exporter and sells products to nearly 60 countries. In 2023 Valio's share of Finland's dairy product exports was above 95%, and almost one third of Finland's food exports. In Finland Valio has a wholesale subsidiary Valionova tukku- ja logistiikkapalvelut Ltd. Subsidiaries Valio Sweden and Valio China sells only products made in Finland. Valio US sells Finnish and Estonian products and they have also some contract productions locally.</p>
Chosen consolidation approach (equity share, operational control, or financial control)	Operational control
Description of the businesses and operations included in the company's organizational boundary	<p>Finland</p> <p>The greenhouse gas emissions reported by Valio under Scope 1 and Scope 2 of the GHG Protocol include all operating in Finland: home office in Helsinki, warehouse in Tuusula, 12 factories around Finland and four wholesale properties by Valionova tukku- ja logistiikkapalvelut Ltd. The functions purchased from Kavli in 2023 have been considered from the time they have become Valio's property.</p> <p>All indirect emissions (not included in Scopes 1 and 2) that occur along Valio's value chain, including both upstream and downstream emissions, are presented in the Scope 3 emissions inventory. The Scope 3 GHG emissions inventory of Valio includes emissions from all operating divisions in Finland.</p>

The division between Scope 1 and 2 is made according to the following principle:

Scope 1

- Heating plants, which produce heat only for Valio
- Refrigerant leaks
- Solar energy (own production)

Scope 2

- Heating plants, which produce heat for Valio and other customers
- District heating
- Purchased electricity

Local breakdown by heating plants and other properties:

Valio Ltd.

Haapavesi

- Scope 1 and 2

Juice factory, Helsinki

- Scope 1

Head office, Helsinki

- Scope 2

Riihimäki

- Scope 1

Joensuu

- Scope 1 and 2

Jyväskylä

- Scope 1

Lapinlahti

- Scope 1

Oulu

- Scope 1

Seinäjoki

- Scope 1

Suonenjoki

- Scope 1 and 2

Turenki

- Scope 2

Vantaa

- Scope 1

Äänekoski

- Scope 1 and 2

Tuusula

- Scope 2

Turku

- Scope 1

Valionova tukku- ja logistiikkapalvelut Ltd.

Sörnäisten pikatukku, Helsinki

- Scope 2

Toimitustukku, Espoo

- Scope 2

Pikatukku, Vantaa

- Scope 2

Toimitustukku, Kuopio

- Scope 2

	<p>Estonia</p> <p>The greenhouse gas emissions reported by Valio (Baltics) under Scope 1 and Scope 2 of the GHG Protocol include all operating in Estonia.</p> <p>The division between Scope 1 and 2 is made according to the following principle:</p> <p>Scope 1</p> <ul style="list-style-type: none"> • Heating plants • Logistics (raw milk collection logistics, own vehicles) <p>Scope 2</p> <ul style="list-style-type: none"> • Purchased electricity
<p>A list of Scope 1 and 2 activities excluded from the report with justification of their exclusion</p>	<p>Scope 1 and 2 are limited outside the inventory:</p> <ul style="list-style-type: none"> • Valio has small properties outside of its offices and factories in Finland. Emissions of those properties bases most on electricity and the usage of electricity in 2023 was about 2% of Valio’s total electricity use and emissions in Finland. Emissions of these properties are excluded from the inventory. • Estonia’s possible refrigerant leaks (scope 1) are excluded because there is no data available. • Swedish and Chinese operations, as they do not manufacture products, there is only smaller marketing organizations, are excluded from the inventory. In 2023 there were 26 employees in Valio China and 68 in Valio Sweden. The greenhouse gas emissions of Valio Sweden are currently being harmonized with the GHG Protocol. • US operations do not have significant scope 1 and 2 emissions (only a small office with 25 employees in 2023).
<p>The reporting period covered</p>	<p>01/01/2023-31/12/2023</p>
<p>A list of scope 3 activities included in the report</p>	<p>The following categories, adapting the GHG Protocol, are included in Valio’s Scope 3 GHG emissions inventory. Under Finland operations are reported Valio Ltd. and Valionova tukku- ja logistiikkapalvelut Ltd.</p> <p>Finland</p> <p>Category 1: Purchased goods and services</p> <ul style="list-style-type: none"> • Raw milk • Berries, fruits, salt, sugar, oil, etc. raw materials used in the manufacture of Valio products • Packaging materials (Valio products) • Wholesale products • Packaging materials used by wholesalers related to the sale of products • Cleaning agents and cleaning services

Category 2: Capital goods

- New constructed production facilities and equipments

Category 3: Fuel- and energy-related activities (not included in Scope 1 and 2)

- Upstream emissions from purchased fuels and heat
- Transmissions and distribution losses from purchased electricity, district heating and heat
- Emissions of peat production and storage

Category 4: Upstream transportation and distribution

- Outsourced contract operators for collecting milk
- Outsourced contract operators for transfers of raw materials between factories
- Purchased freight logistics
- Outsourced contract operators for transfers of finished products between stocks
- Outsourced retail and wholesale logistics

Category 5: Waste generated in operations

- Waste in Valio's factories and offices
- Waste in wholesale properties

Category 6: Business travel

- Business flights
- Leased cars, travel allowances and train travel
- Hotel accommodations

Category 7: Employee commuting

- Employee commuting (car and public transport)

Category 10. Processing of sold products

- Sold products

Category 11: Use of sold products

- Sold products

Category 12. End-of-life treatment of sold products

- Sold products

<p>A list of Scope 3 activities excluded from the report with justification of their exclusion</p>	<p>The following list presents the Scope 3 activities excluded from the report with justification for their exclusion by category:</p> <p>Finland</p> <p>Category 8: Upstream leased assets</p> <ul style="list-style-type: none"> • This category is not relevant for Valio. Valio does not have assets that are leased for other companies and are not already included in the company's Scope 1 or Scope 2 inventories. <p>Category 9: Downstream transportation and distribution</p> <ul style="list-style-type: none"> • This category is not relevant for Valio, since all the Valio's logistics are in category 4 <p>Category 11a: Downstream emissions from fossil fuels distributed but not sold by the company</p> <ul style="list-style-type: none"> • This category is not relevant for Valio, since Valio does not distribute any fossil fuels. <p>Category 13: Downstream leased assets</p> <ul style="list-style-type: none"> • This category is not relevant for Valio. Valio does not have assets that are leased for other companies and are not already included in the company's Scope 1 or Scope 2 inventories. <p>Category 14: Franchises</p> <ul style="list-style-type: none"> • This category is not relevant for Valio, since Valio has no franchise activities. <p>Category 15: Investments</p> <ul style="list-style-type: none"> • This category is not relevant for Valio, since Valio has no financial investments. <p>Estonia</p> <p>Scope 3 in Estonia was screened* in 2022 (2021 data) and there were no relevant changes in operations in Estonia in 2023. Those screened emissions were not so relevant compared to Valio Finland's scope 3, so they have so far been excluded from the inventory. Estonia's scope 3 emissions were roughly estimated as 6% of Valio Finland's scope 3 emissions and the emissions on Finnish raw milk were still 81% of total Finland and Estonian scope emissions. The greenhouse gas emissions of Valio Baltics are currently being harmonized with the GHG Protocol.</p> <p>Category 1: Purchased goods and services</p> <ul style="list-style-type: none"> • Raw milk • Other ingredients • Packaging materials • Cleaning agents <p>Category 2: Capital goods</p> <ul style="list-style-type: none"> • Investments e.g. in Valio's infrastructure
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Category 3: Fuel- and energy-related activities (not included in Scope 1 and 2)

- Transmissions and distribution losses from purchased electricity and heat

Category 4: Upstream transportation and distribution

- Logistics paid by Valio
- Milk collection logistics already included in scope 1 emissions

Category 5: Waste generated in operations

- Waste in Valio's factories and offices

Category 6: Business travel

- No data is available for this, but the majority of Valio Group's business travel takes place in the Finnish head office operations.

Category 7: Employee commuting

- Employee commuting (car and public transport)

Category 8: Upstream leased assets

- Upstream leased assets

Category 9: Downstream transportation and distribution

- Logistics, that is not paid by Valio

Category 10: Processing of sold products

- Sold products

Category 11: Use of sold products

- Sold products

Category 11a: Downstream emissions from fossil fuels distributed but not sold by the company

- This category is not relevant for Valio, since Valio does not distribute any fossil fuels.

Category 12: End-of-life treatment of sold products

- Sold products

Category 13: Downstream leased assets

- Downstream leased assets

Category 14: Franchises

- Franchises

	<p>Category 15: Investments</p> <ul style="list-style-type: none">• This category is not relevant for Valio, since Valio has no financial investments. <p>Sweden and China</p> <ul style="list-style-type: none">• Scope 3 is not relevant for these marketing operations, because they sell only Valio products manufactured in Finland (most of the emissions are already included in Valio Finland emissions). In 2023 there were 26 employees in Valio China and 68 in Valio Sweden. The greenhouse gas emissions of Valio Sweden are currently being harmonized with the GHG Protocol. <p>United States (US)</p> <ul style="list-style-type: none">• Valio US is a marketing organization (25 employees selling Valio Finland and Estonia products) with a small scale of contract manufacturing locally. The emissions of contract manufactured products in Valio USA have been roughly estimated for 2023 based on product types and volumes (kilograms, kg) and average carbon footprint of the products. Those emissions were about 49 000 tons CO₂e, which is about 2,4 % of Valio Finland's total scope 3 emissions. Those emissions are so far excluded from the inventory (not so relevant compared to Valio Finland's total scope 3 emissions).
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Part 2: Greenhouse gas emissions data

Scopes 1 and 2	Metric tons CO ₂ e
Scope 1: Direct emissions from owned/controlled operations	<p>Finland 39300</p> <p>Estonia 9600</p>
Scope 2: Indirect emissions from the use of purchased electricity, steam, heating, and cooling	<p>Finland</p> <p><u>Location based</u> purchased electricity: 19100</p> <p><u>Market based</u> purchased electricity: 93900</p> <p>Heating & cooling: 4900</p> <p>District heating 2300</p> <p>Estonia</p> <p><u>Location based</u> purchased electricity: 16700</p> <p><u>Market based</u> purchased electricity: 11300</p>

Scope 3					
No.	Category	Metric tons CO ₂ e	Primary data 1)	Secondary data, estimation 2)	% of total scope 3 emissions
Upstream emissions					
1	Purchased goods and services	Finland Raw milk 1733200 Other purchased goods and services 91600	80 % 80 %	20 % 20 %	85,8 4,5
2	Capital goods	Finland 4200	100 %		0,2
3	Fuel- and energy-related activities (not included in Scope 1 or Scope 2)	Finland 21500	100 %		1,1
4	Upstream transportation and distribution	Finland Milk collection logistics 15000 Other Upstream logistics 26200	100 % 100 %		0,7 1,3
5	Waste generated in operations	Finland 1900	100 %		0,1
6	Business travel	Finland 1600	100 %		0,1
7	Employee commuting 3)	Finland 2900	61 %	39 %	0,1
8	Upstream leased assets	N/A			

Downstream emissions					
10	Processing of sold products	Finland 44500	100 %		2,2
11	Use of sold products	Finland 63900	100 %		3,2
11a	Category 11a: Downstream emissions from fossil fuels <i>distributed but not sold by the company</i>	N/A			
12	End-of-life treatment of sold products	Finland 14300	100 %		0,7
13	Downstream leased assets	N/A			
14	Franchises	N/A			
15	Investments	N/A			

Other reported emissions outside of the GHG Protocol	Metric tons CO ₂ e	Primary data 1)	Secondary data, estimation 2)
Land use (LU) emissions in milk production	Finland 684100	80 %	20 %

1) Primary data: Calculations based on company-specific data

2) Secondary data: Calculations based on generic or industry average data from published sources, estimation, or extrapolated data

Part 3: Description of methodologies and data used

Scope	Methodologies used to calculate or measure emissions, providing a reference or link to any calculation tools used
Scope 1	<p>Activity data:</p> <ul style="list-style-type: none"> Oil, gas, peat and renewable energy sources (different wood materials): MWh of heat produced with oil, gas, peat and wood as measured and registered in Valio's facilities in collaboration with heat energy suppliers Refrigerant leaks: kilograms (kg) of substance as reported fill-ups of the equipment by the service provider for each Valio's factory (no data available from Estonia). Milk collection logistics: mileage monitoring (primary data, Valio) <p>Emission factors (secondary data):</p> <p>Finland</p> <ul style="list-style-type: none"> Primarily: emission figures from heat suppliers Necessary clarifications and verification: oil, gas, peat, and renewable energy sources (different wood materials): Tilastokeskus Polttoaineluokitus 2023. https://www.stat.fi/tup/khkinv/khkaasut_polttoaineluokitus.html Refrigerant leaks: EU (EU) N:o 517/2014, appendix 1: https://tukes.edilex.fi/sv/eu-lainsaadanto/32014R0517/fi?allWords=73%2F2021&search=true and emission factors from suppliers (e.g. Linde https://www.linde-gas.com/what-we-offer/gases/refrigerants) <p>Estonia</p> <ul style="list-style-type: none"> Heating: Emissions from fuels. https://www.riigiteataja.ee/akt/108032019006?leiaKehtiv Logistics: Diesel, natural gas and biogas: https://www.stat.fi/tup/khkinv/khkaasut_polttoaineluokitus.html
Scope 2	<p>Activity data:</p> <ul style="list-style-type: none"> Oil, gas, peat and renewable energy sources (different wood materials): MWh of heat produced with oil, gas, peat and wood as measured and registered in Valio's facilities in collaboration with heat energy suppliers Electricity and district heat: consumption data in MWh based on suppliers' measurement <p>Emission factors:</p> <p>Finland</p> <ul style="list-style-type: none"> Primarily: emission figures from heat suppliers Oil, gas, peat and renewable energy sources (different wood materials): Tilastokeskus Polttoaineluokitus 2023. https://www.stat.fi/tup/khkinv/khkaasut_polttoaineluokitus.html District heating: Supplier specific emission factors: Helen 223 CO₂e kg / MWh (only 2022 factor available on early 2023) https://www.helen.fi/yriytykset/lampoa-yriytyksille/kaukolampoa-yriytykselle#alkupera Fortum 107,8 CO₂e kg / MWh https://www.fortum.fi/yriytyksille-ja-yhteisoille/lammitys-ja-jaahdytys/kaukolampo/kaukolampoa-yha-puhtaammin/kaukolammon-tuotantoluvut Savon Voima 171 CO₂e kg / MWh Information directly from the heat supplier by email (2023 factor)

	<p>Kuopion energia 104 CO₂e kg / MWh https://www.kuopionenergia.fi/kotitaloudet/lampoa-kotiisi/lammon-alkupera-koti-lampo/ Vantaan energia 149,3 CO₂e kg / MWh https://www.vantaanenergia.fi/lampo/vantaalainen-lampo-on-hintavakaa-ja-ilmastoystavallinen-lammitysratkaisu/</p> <ul style="list-style-type: none"> • Electricity (market-based): Finland 2023 Residual mix 471,27 CO₂e kg / MWh (2023 was not available in early 2024) Jäännösjakauma+2022+julkaisu+Fi.pdf (energiavirasto.fi) • Electricity (location-based): Country specific emission factor in Finland 77 CO₂e / MWh (2023 was not available in early 2024) https://www.motiva.fi/ratkaisut/energian kaytto suomesa/co2-laskentaohje_energian kulutuksen hiilidioksidipaastojen laskentaan/co2-paastokertoimet <p>Estonia</p> <ul style="list-style-type: none"> • Electricity (market-based): Estonia 2021 Residual mix 636,58 CO₂e / MWh (2023 was not available in early 2024) https://elering.ee/en/residual-mix • Electricity (location-based): Country specific emission factor in Estonia 946,0 CO₂e kg / MWh. European Environment Agency https://www.eea.europa.eu/data-and-maps/daviz/co2-emission-intensity-12/#tab-chart_2
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Scope 3 category	Description of the types and sources of data used to calculate emissions	Description of the methodologies, allocation methods and consumptions used to calculate emissions*	Percentage (%) of emissions calculated using data obtained directly from suppliers or other value chain partners
1. Purchased goods and services	Description: This is the most important category for Valio, as it includes all the raw materials used in factory production. The following purchased goods cover most of the Category 1. Data have been collected extensively from Finnish operations.	<p>Coverage in category level: Coverage in category level is calculated based on the value of purchases (euros) meaning that, measured in euros, most of this category is included in the emissions calculations.</p> <p>Coverage in product or service level: Coverage in the product level (raw milk, salt, berries, packaging materials, cleaning services, wholesale products, etc.) is calculated based on the value (euros) or on the amount (kilograms, kg, liters, l or pieces, pcs.) of purchased products. If the coverage of the emission calculations does not cover the whole product or service level, the results have been extended to the rest of this category to 100%. Data is refined annually.</p> <p>Coverage</p> <ul style="list-style-type: none"> • Raw milk (100%) • Salt, sugar, vegetable oils, orange juices, berries and fruits (almost 100%) • Packaging materials (100%) • Cleaning agents and services (almost 100%) • Wholesale products and packaging materials (100%) 	<p>Finland</p> <p>Raw milk 80%</p> <p>Other raw materials 0%</p> <p>Packages 40%</p> <p>Cleaning agents and cleaning services 0%</p> <p>Wholesale products and packaging materials 0%</p>

	<p><u>Raw milk</u></p> <p>Milk produced by Finnish farms is Valio's most important raw material and the most significant (86%) emission source in scope 3. Emissions from land use in milk production were reported at first time in 2023 and retroactively for the years 2019-2022. These emissions are for the time being reported separately at the end of the report.</p> <p>Activity data (primary data): The data is based on the amount of milk (l) converted to kilograms (kg) and its content (protein, fat and lactose) received from the Finnish farms by Valio in 2023.</p> <p>Emission factors (secondary data): Raw milk emissions calculation is based on a systematic farm level (Tier 3) life cycle assessment (LCA). The average carbon footprint of raw milk received by Valio Finland is 0,95 CO₂e. kg / 1 kg energy corrected milk (ECM). This carbon footprint does not include emissions from land use in dairy farms, those emissions are reported separately in this report. The most recent farm level data is from 2022.</p> <p>This emission factor is based on:</p> <ul style="list-style-type: none"> Valio's Carbo® Farm Calculator (LCA model "Lypsikki LCA" certified annually by Carbon Trust). At this point the Valio's own carbon footprint data covers 80 percent of the milk received by Valio in 2022. The carbon footprints of the rest of the dairy farms will be calculated in the future, which further improves the accuracy. The goal is for all dairy farms to calculate their carbon footprint annually. 	<p><u>Raw milk</u></p> <p>Coverage: All the milk received by Valio in Finland in 2023.</p> <p>Default: One liter (l) of milk is 0,95 kilogram (kg)</p> <p>Method: Amount of raw milk (kg) multiplied by the average footprint of the raw milk of Valio dairy farms.</p> <p>System boundary: Cradle-to-gate</p> <p>Functional unit: kg ECM (kg of energy corrected milk)</p> <p>Characterization factors:</p> <p>IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2391 pp. doi:10.1017/9781009157896.</p> <p>Included emissions sectors according to PEF CR (EDA. 2018. Product Environmental Footprint Category Rules. European Dairy Association. Quantis Switzerland. EPFL Innovation Park. Bât. D, 1015 Lausanne - Switzerland. Final PEF CR version.) and IDF (Guinard, C., F. Verones and Y. Loerincik. 2009. Environmental/ecological impact of the dairy sector: Literature review on dairy products for an inventory of key issues, list of environmental initiative and influences on the dairy sector. Bulletin of the International Dairy Federation (Report 436). Brussels, Belgium: International Dairy Federation.)</p> <p>Allocation method between raw milk and beef: Energy content allocation</p>	
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	<ul style="list-style-type: none"> Lypsikki LCA calculation method was updated to be even more accurate on farm level in the fall of 2023, when the raw milk emission calculation for the years 2019-2022 was also retroactively updated. However, the change in total emissions was not significant. Base study: A study of the carbon footprint of Valio's raw milk: Astaptsev, A. 2018. Carbon footprint of raw milk production – modeling and impact assessment https://aaltodoc.aalto.fi/handle/123456789/32366 <p><u>Salt</u></p> <p>Activity data (primary data): Data from purchase reports (kg)</p> <p>Emission factors (secondary data): Salt Market Info, CarboTech https://saltmarketinfo.com/the-future-of-salt-and-the-carbon-footprint/</p> <p><u>Sugar</u></p> <p>Activity data (primary data): Data from purchase reports (kg)</p> <p>Emission factors (secondary data): Nordic Sugar https://www.nordzucker.com/en/nordzucker-together-sustainable/sustainability-in-figures/</p>	<p>LCA time period: One calendar year</p> <p>According to IPCC Guidelines for National Greenhouse Gas Inventories almost all in-farm GHG emission calculations methods were Tier 3. Off-farm emissions were Tier 1 and 2 (IPCC, 2006. In: Egelston, S., Buendia, L., Miwa, K., Ngara, T., Tanabe, K. (Eds.), 2006 IPCC Guidelines for National Greenhouse Gas Inventories— Volume 4: Agriculture, forestry and other land use. IGES, Japan.)</p> <p><u>Salt, sugar, vegetable oils, juices, fruits, berries and crops</u></p> <p>Coverage: All the salts, sugars and vegetable oils are included in the calculations. The most important juices, fruits, berries and crops are included.</p> <p>Method: The calculations are based on the general emission factors of the most significant raw materials, which were used to multiply the use volumes in kilograms (kg). Primary data on the climate impact of raw materials were not available from suppliers. Results have been extended to the rest of purchased raw materials.</p>	
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	<p><u>Vegetable oils</u></p> <p>Activity data (primary data): Data from purchase reports (kg)</p> <p>Emission factors (secondary data): Environmental Life Cycle Assessment of Rapeseed and Rapeseed Oil Produced in Northern Europe: A Latvian Case Study https://www.mdpi.com/2071-1050/12/14/5699</p> <p><u>Berries, fruits and crops</u></p> <p>Activity data (primary data): Data from purchase reports (kg)</p> <p>Emission factors (secondary data):</p> <p>Strawberry CarbonScopeData CarbonScopeData - CleanMetrics</p> <p>Blueberry CarbonScopeData CarbonScopeData - CleanMetrics</p> <p>Raspberry CarbonScopeData CarbonScopeData - CleanMetrics</p> <p>Boysenberry CarbonScopeData CarbonScopeData - CleanMetrics</p> <p>Mango CarbonScopeData CarbonScopeData - CleanMetrics</p>		
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	<p>Peach CarbonScopeData CarbonScopeData - CleanMetrics</p> <p>Banana CarbonCloud "banana" CarbonCloud</p> <p>Apple Climatiq Climatiq Data Explorer - Search Global Carbon Emission Factors</p> <p>Orange Climatiq Climatiq Data Explorer - Search Global Carbon Emission Factors</p> <p>Ananas HAMK Häme University of Applied Sciences: Ruoka-ainekortit, 2021 https://mappa.fi/wp-content/uploads/2021/03/ruokakortit.pdf</p> <p>Grape HAMK Häme University of Applied Sciences: Ruoka-ainekortit, 2021 https://mappa.fi/wp-content/uploads/2021/03/ruokakortit.pdf</p> <p>Perry Climatiq Climatiq Data Explorer - Search Global Carbon Emission Factors</p> <p>Oat Rajaniemi, Mari & Mikkola, Hannu & Ahokas, J. (2011). Greenhouse gas emissions from oats, barley, wheat and rye production. Agronomy Research. 9. (PDF) Greenhouse gas emissions from oats, barley, wheat and rye production (researchgate.net)</p>		
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	<p><u>Packaging materials</u></p> <p>Activity data (primary data): Sievo CO₂ Analytics. Data from invoices (euro)</p> <p>Emission factors (secondary data): Emission factors from Sievo CO₂ Analytics:</p> <p>Exiobase Exiobase - Home</p> <p>Ecoinvent ecoinvent Database - ecoinvent</p> <p>Emission factors provided by supplier: Liquid board: Accurate data from Tetrapak. All Packages Tetra Pak ProductExplorer</p> <p><u>Cleaning agents</u></p> <p>Activity data (primary data): Sievo CO₂ Analytics. Data from cleaning service invoices (euro)</p> <p>Emission factors (secondary data): Emission factors from Sievo CO₂ Analytics:</p> <p>Exiobase Exiobase - Home</p>	<p><u>Packaging materials</u></p> <p>Coverage: Emission calculations for packaging materials used in Valio products cover 100 % of the amount of packaging materials used in 2023 in kilograms (kg), pieces (pcs.) or in euros.</p> <p>Method: The emissions of all packaging materials used for Valio products were estimated with Sievo CO₂ analytics Tool.</p> <p><u>Cleaning agents</u></p> <p>Coverage: Emission calculations for cleaning agents used in Valio's properties cover 100 % of the cleaning agents used in 2023 in kilograms (kg), pieces (pcs.) or in euros.</p> <p>Method: The emissions of all packaging materials used for Valio products were estimated with Sievo CO₂ analytics Tool.</p>	
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	<p><u>Cleaning services</u></p> <p>Activity data (primary data): Sievo CO₂ Analytics. Data from cleaning service invoices (euro)</p> <p>Emission factors (secondary data): Emission factors from Sievo CO₂ Analytics:</p> <p>Exiobase Exiobase - Home</p> <p><u>Wholesale products</u></p> <p>Activity data (primary data): Sievo CO₂ Analytics. Data from cleaning service invoices (euro)</p> <p>Emission factors (secondary data): Emission factors from Sievo CO₂ Analytics:</p> <p>Ecoinvent ecoinvent - Data with purpose.</p> <p><u>Packaging materials used in wholesale properties</u></p> <p>Activity data (primary data): Data from purchase reports (kg)</p> <p>Emission factors (secondary data): Climatiq Climatiq Data Explorer - Search Global Carbon Emission Factors</p> <p>Fefco https://www.fefco.org/sites/default/files/documents/The%20carbon%20footprint%20of%20corrugated%20packaging%202018%20final-recalculated%202019%201.pdf</p>	<p><u>Cleaning services</u></p> <p>Coverage: Head office in Helsinki and all the wholesale properties in Helsinki, Espoo, Vantaa and Kuopio.</p> <p>Method: The emissions of all cleaning services were estimated with Sievo CO₂ analytics Tool.</p> <p><u>Wholesale products</u></p> <p>Coverage: The emission calculation is based on all the wholesale products purchased in 2023</p> <p>Method: The emissions of all cleaning services were estimated with Sievo CO₂ analytics Tool.</p> <p><u>Packaging materials used in wholesale properties</u></p> <p>Coverage: Packaging materials used in all wholesale properties in Helsinki, Espoo, Vantaa and Kuopio.</p> <p>Method: The calculations are based on the general emission factors which were used to multiply the purchase volumes. Primary data on the climate impact of packaging materials were not available from suppliers.</p>	
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2. Capital goods	<p>Activity data (primary data): Valio's investments in 2023 were Valio Ltd. 72,3 million euros and Valionova tukku- ja logistiikkapalvelut Ltd. 1 million euros.</p> <p>Emission factors (secondary data): Climatiq Climatiq Data Explorer - Search Global Carbon Emission Factors</p>	<p>Coverage: Valio Ltd. and Valionova tukku- ja logistiikkapalvelut Ltd.</p> <p>Method: There was no detailed information available on the climate impact of the investments, so an estimate based on euros was used in the calculation.</p>	0%
3. Fuel- and energy-related activities (not included in Scope 1 and 2)	<p>Activity data (primary data): Fuel and energy use data was gathered from Valio's and Valionova tukku- ja logistiikkapalvelut Ltd.'s operational systems.</p> <p>Emission factors (secondary data): Defra Transmissions and distribution losses from purchased electricity, burning oil and natural gas https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019</p> <p>Emissions from peat production: VTT Technical Research Centre of Finland https://www.bioenergia.fi/wp-content/uploads/2020/05/Turpeen-tuotanto-ja-k%C3%A4ytt%C3%B6-yhteenveto-selvityksist%C3%A4-VTT-tiedotteita-2550-.pdf</p>	<p>Coverage: Transmissions and distribution losses from purchased electricity, district heating and well to tank (WTT) emissions from use of burning oil, natural gas, bioenergy and peat.</p> <p>Method: Calculated based on fuel consumption used for scope 1 and 2 calculations and corresponding VTT factories. Transmission and distribution losses from electricity and district heat consumption were calculated based on scope 2 electricity and district heat consumption and emission factories from Defra.</p>	0%

<p>4. Upstream transportation and distribution</p>	<p><u>Milk collection and logistics between factories</u></p> <p>Activity data (primary data): Data of the kilometers driven are taken from logistics partner's reported mileage from driving reports. The average consumption of the vehicles (fuel used) is calculated as a weighted average. The kilometers driven by biogas have been deducted from the kilometers and have been calculated separately so that emissions are 85% lower compared to diesel.</p> <p>Emissions factors (secondary data):</p> <p>Diesel Tilastokeskus Polttoaineluokitus 2023 khkaasut_polttoaineluokitus_2023.xlsx (live.com)</p> <p>Biogas VTT Technical Research Centre of Finland: https://cris.vtt.fi/ws/portalfiles/portal/26329817/REDII_raportti_pivitys_final.pdf An emission factor is used for biogas, according to which biogas emissions are 85% lower compared to diesel.</p> <p><u>Freight logistics</u></p> <p>Activity data (primary data): Data from purchase reports (euro) of freight logistics</p> <p>Diesel Tilastokeskus Polttoaineluokitus 2023 khkaasut_polttoaineluokitus_2023.xlsx (live.com)</p>	<p><u>Milk collection and logistics between factories</u></p> <p>Coverage: Outsourced contract operators for collecting milk and outsourced contract operators for transfers of raw materials between factories</p> <p>Method: Calculations are based on contracted logistics partners' reported mileage and related GHG emissions.</p> <p><u>Freight logistics</u></p> <p>Coverage: Purchased freight logistics</p> <p>Method: The calculations are based on the freight logistics volumes in euros and emission factors converted to a suitable unit</p>	<p>100%</p>
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<p>5. Waste generated in operations</p>	<p><u>Valio Ltd.</u></p> <p>Activity data (primary data) and emission factors (secondary data): Zero Waste Tool. https://new.zerowaste.fi/frontpage</p> <p><u>Valionova tukku- ja logistiikkapalvelut Ltd.</u></p> <p>Activity data (primary data): Waste reports by facilities. Emission factors (secondary data): WWF Climate Tool. WWF Green Office - Ilmastolaskuri</p>	<p>Coverage: All waste management</p> <p><u>Valio Ltd.</u></p> <p>Method: Valio uses Zero Waste Tool, which is an application provided by Itä-Suomen Murskauskus (coordinator of all Valio's waste management) to estimate the emissions from the treatment of all Valio Finland's waste. The tool utilizes the latest emission factors for waste management and considers emissions over the life cycle of the process.</p> <p><u>Valionova tukku- ja logistiikkapalvelut Ltd.</u></p> <p>Method: Waste types in kilograms (kg) were brought into WWF Climate calculator.</p>	<p>99%</p>
<p>6. Business travel</p>	<p>Activity data (primary data):</p> <p>Emissions of business flights: Valio Air Carbon Emission 2023 Jan-Dec GBT</p> <p>Emissions from accommodation and business travelling by rental car: Valio Oy GHG Hotel and Car Emission 2023 GBT</p> <p>Business travelling by train: VR Group's contract customers' travel and purchase report 2023 (kilometers)</p> <p>Emissions from business travelling by car: Business travelling by car: Valio staff mileage allowances (kilometers)</p> <p>Emission factors (secondary data):</p> <p>Emissions from flights, business accommodation and business travelling by rental car are calculated by travel agency (American Express Global Business Travel), emission factors from UK BEIS.</p>	<p>Coverage: Business flights, train travel, leased car, Valio staff mileage allowances and business accommodation</p> <p>Method: Data provided by travel agency for flights, rental car and accommodation, other business travel calculated based on emission factors and distances.</p>	<p>74%</p>

	<p>Train travel in Finland is carbon neutral. VR Group: https://ilmastoraiteilleen.vr.fi/ and https://www.vrgroup.fi/fi/vrgroup/ uutishuone/uutiset-ja-tiedotteet/jokainen-junamatka-on-ilmastoteko---aivan-kaikki-suomen-matkustajajunat-kulkevat-jatkossa-hiilineutraalisti-031220190655/</p> <p>Emissions factor for business travelling by car: Tilastokeskus Polttoaineluokitus 2023 khkaasut_polttoaineluokitus_2023.xlsx (live.com)</p>		
7. Employee commuting	<p>Activity data (primary data): Commuting emissions for employees have been estimated based on average distance and travel mode of commuting travel. Employee survey conducted in 2020 and updated annually based on the number on personnel per location.</p> <p>Emission factors (secondary data): Tilastokeskus Polttoaineluokitus 2023 khkaasut_polttoaineluokitus_2023.xlsx (live.com)</p>	<p>Coverage: Valio Oy and Valionova tukku- ja logistiikkapalvelut Ltd.</p> <p>Method: Calculated based on sample (61%) extended to 100%</p>	0%
10. Processing of sold products	<p>Activity data (primary data): Valio's Sales Report 2023 (kg)</p> <p>Emission factors (secondary data): PEFCR (EDA. 2018. Product Environmental Footprint Category Rules. European Dairy Association. Quantis Switzerland. EPFL Innovation Park. Bât. D, 1015 Lausanne - Switzerland. Final PEFCR version.) and IDF (Guinard, C., F. Verones and Y. Loerincik. 2009. Environmental/ecological impact of the dairy sector: Literature review on dairy products for an inventory of key issues, list of environmental initiative and influences on the dairy sector. Bulletin of the International Dairy Federation (Report 436). Brussels, Belgium: International Dairy Federation.) https://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR_en.htm</p>	<p>Coverage: Valio products made in Finland</p> <p>Method: The calculations are based on the emission factor which were used to multiply the weight (kg) of sold products in 2023. The emission factors are based on a report from the European Commission, which calculates the life-cycle climate impact of various products, such as the shares of these categories.</p>	0%

11. Use of sold products	<p>Activity data (primary data): Valio's Sales Report 2023 (kg)</p> <p>Emission factors (secondary data): PEFCR (EDA. 2018. Product Environmental Footprint Category Rules. European Dairy Association. Quantis Switzerland. EPFL Innovation Park. Bât. D, 1015 Lausanne - Switzerland. Final PEFCR version.) and IDF (Guinard, C., F. Verones and Y. Loerincik. 2009. Environmental/ecological impact of the dairy sector: Literature review on dairy products for an inventory of key issues, list of environmental initiative and influences on the dairy sector. Bulletin of the International Dairy Federation (Report 436). Brussels, Belgium: International Dairy Federation.)</p> <p>https://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR_en.htm</p>	<p>Coverage: Valio products sold in 2023</p> <p>Method: The calculations are based on the emission factor which were used to multiply the weight (kg) of sold products in 2023. The emission factors are based on a report from the European Commission, which calculates the life-cycle climate impact of various products, such as the shares of these categories.</p>	0%
12. End-of-life treatment of sold products	<p><u>Valio products</u></p> <p>Activity data (primary data): Valio's Sales Report 2023 (kg)</p> <p>Emission factors (secondary data): PEFCR (EDA. 2018. Product Environmental Footprint Category Rules. European Dairy Association. Quantis Switzerland. EPFL Innovation Park. Bât. D, 1015 Lausanne - Switzerland. Final PEFCR version.) and IDF (Guinard, C., F. Verones and Y. Loerincik. 2009. Environmental/ecological impact of the dairy sector: Literature review on dairy products for an inventory of key issues, list of environmental initiative and influences on the dairy sector. Bulletin of the International Dairy Federation (Report 436). Brussels, Belgium: International Dairy Federation.)</p> <p>https://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR_en.htm</p>	<p>Coverage: Valio products sold in 2023 and all the wholesale products sold in 2023</p> <p><u>Valio products</u></p> <p>Method: The calculations are based on the emission factor which were used to multiply the weight (kg) of sold products in 2023. The emission factors are based on a report from the European Commission, which calculates the life-cycle climate impact of various products, such as the shares of these categories.</p> <p>Further clarification: Referring to the same European Commission source, the emission factor for Category 12 is negative, as it considers the circular economy. In Finland, for example, cardboard has a very high recycling rate and several of Valio's plastic packaging are made from recycled plastic.</p>	0%

	<p><u>Wholesale products</u></p> <p>Activity data (primary data): Valio's Wholesale Report 2023 (kg)</p> <p>Activity data (secondary data): Calculations made using the ratio from year 2022 between calculation units</p>	<p><u>Wholesale products</u></p> <p>Method: Emission calculation is based on the total amount of sold wholesale products (kg) and the ratio from year 2022 between calculation units (screening), because GHG Protocol Scope 3 Evaluator tool Quantis was no longer in use (Scope 3 Evaluator (quantis-suite.com)). New calculation methods will be mapped for 2024 data.</p>	
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Other reported emissions outside of the GHG Protocol	Description of the types and sources of data used to calculate emissions	Description of the methodologies, allocation methods and consumptions used to calculate emissions*	Percentage (%) of emissions calculated using data obtained directly from suppliers or other value chain partners
Land use (LU) emissions in milk production	<p><u>Finland</u></p> <p>Activity data (primary data): See section: Scope 3, Category 1: Raw milk</p> <p>Emission factors (secondary data): See section: Scope 3, Category 1: Raw milk</p> <p>Emission factors (secondary data): Raw milk emissions calculation is based on a systematic farm level (Tier 3) life cycle assessment (LCA). The average carbon footprint of land use (LU) in dairy farms is 0,38 CO₂e. kg / 1 kg energy corrected raw milk (ECM) received by Valio Finland. The most recent farm level data is from 2022.</p>	See section Scope 3: Category 1: Raw milk	80%

*Estonia: scope 3 screened based on category 1 data and raw milk received ratio (Estonia/Finland 0,12). This was of enough accuracy, as Finnish raw milk emissions cover 81 % of scope 3 in 2019 and 86,6 % in 2021. The scope 3 emissions of Valio Baltics (Estonia) are so far excluded from the Valio's GHG inventory.

Independent practitioner's limited assurance report

To the Management of Valio Group

We have been engaged by the Management of Valio Group (hereinafter also the "Company") to perform a limited assurance engagement on sustainability information for the reporting period from 1 January 2023 to 31 December 2023, disclosed in Valio Group's Greenhouse Gas (GHG) Inventory report 2023 disclosed on the Company's website (hereinafter the Selected sustainability information).

Selected sustainability information

The selected sustainability information within the scope of assurance covers the information on the

- Direct (Scope 1) GHG emissions,
- Energy indirect (Scope 2) GHG emissions
- Other indirect (Scope 3) GHG emissions

presented in the Greenhouse Gas (GHG) Inventory report 2023 of Valio Group.

Management's responsibility

The Management of Valio Group is responsible for preparing the Selected sustainability information in accordance with the Reporting criteria as set out in Greenhouse Gas Protocol Standards. The Management of Valio Group is also responsible for such internal control as the management determines is necessary to enable the preparation of the Selected sustainability information that is free from material misstatement, whether due to fraud or error.

Practitioner's independence and quality management

We have complied with the independence and other ethical requirements of the International Code of Ethics for Professional Accountants (including International Independence Standards) issued by the International Ethics Standards Board for Accountants (IESBA code), which is founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behavior.

PricewaterhouseCoopers Oy applies International Standard on Quality Management (ISQM) 1, which requires the firm to design, implement and operate a system of quality management including policies or procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

Practitioner's responsibility

Our responsibility is to express a limited assurance conclusion on the Selected sustainability information based on the procedures we have performed and the evidence we have obtained. We conducted our limited assurance engagement in accordance with the International Standard on Assurance Engagements (ISAE) 3000 (revised) "Assurance Engagements Other than Audits or Reviews of Historical Financial Information", and, in respect of greenhouse gas emissions, International Standard on Assurance Engagements (ISAE) 3410 "Assurance Engagements on Greenhouse Gas Statements". These standards require that we plan and perform the engagement to obtain limited assurance about whether the Selected sustainability information is free from material misstatement.

In a limited assurance engagement, the evidence-gathering procedures are more limited than for a reasonable assurance engagement, and therefore less assurance is obtained than in a reasonable assurance engagement. An assurance engagement involves performing procedures to obtain evidence about the amounts and other information in the Selected sustainability information. The procedures selected depend on the practitioner's judgment, including an assessment of the risks of material misstatement of the Selected sustainability information.

Our work consisted of, amongst others, the following procedures:

- Interviewing representatives of the Company.
- Performing a virtual site visit in the Company's site to evaluate the processes and IT systems and how site level data is collected and consolidated into the Company's reporting.
- Interviewing employees responsible for collecting and reporting the Selected sustainability information at the Group level.
- Assessing how the reporting instructions and procedures are applied in the Company.
- Testing the accuracy and completeness of the Selected sustainability information from original documents and systems on a sample basis.
- Testing the consolidation of the Selected sustainability information and performing recalculations on a sample basis.
- Considering the disclosure and presentation of the Selected sustainability information.

Limited assurance conclusion

Based on the procedures we have performed and the evidence we have obtained, nothing has come to our attention that causes us to believe that Valio Group's Selected sustainability information for the reporting period ended 31 December 2023 is not properly prepared, in all material respects, in accordance with the Reporting criteria.

When reading our limited assurance report, the inherent limitations to the accuracy and completeness of the Selected sustainability information should be taken into consideration.

Our assurance report has been prepared in accordance with the terms of our engagement. We do not accept, or assume responsibility to anyone else, except to Valio Group for our work, for this report, or for the conclusion that we have reached.

Helsinki 24 April 2024

PricewaterhouseCoopers Oy

Mikael Niskala

Partner, Sustainability Reporting & Assurance

PricewaterhouseCoopers Oy

Niina Vilske

Partner, Authorised Public Accountant (KHT)