The Chocolate Family's management summary
Corporate Carbon Footprint – GHG calculations 2023

The Chocolate Family's (TCF) board has commissioned Climates to execute the 2023 footprint calculation to enable a base year measurement, while also annually providing policy and goal setting towards 2050 to stay within the 1,5-degree pathway of global warming.

Methodology and boundaries

TCF's total Green House Gas (GHG) emissions for fiscal year 2023 were evaluated in line with the GHG Protocol, ISO 14064, the Science Based Targets initiative (SBTi), CSRD reporting, and stakeholder communications requirements. TCF gathered and validated data from its operations and value chain, including Forestry, Land-use, and Agriculture (FLAG), mapping them to emission factors for analysis. They quantified the total GHG-emissions, defining boundaries for Scope 1, 2, and 3 emissions, and incorporating FLAG-related activities. Data on energy use, fuel, waste, and FLAG emissions were converted into CO2-equivalents and compiled into a transparent report, which can be verified by third parties for accuracy.

Figure 7 on page 7 shows the details of the full assessment, including the data reliability per Category.

The GHG Protocol recognizes a total of 23 categories distributed over the three scopes (see figure below). Based on TCF's operations and value chain, 11 of these categories are deemed out of scope as they are not applicable. Leaving 12 categories as relevant for assessment.

- **Scope 1**: TCF buys, produces and sells chocolate and chocolated related products and has its own product processing and refinement within its direct operations. However, Category 1.3 (process emissions) was not considered in this assessment. Leaving 1.1 (stationary emissions), 1.2 (mobile emissions) and 1.4 (fugitive emissions) Categories that have been reported on.

- **Scope 2**: TCF has not purchased any steam, heat, or cooling, hence the omission of Categories 2.2, 2.3, and 2.4. The purchase of electricity (2.1) is the only category of relevance to Scope 2. This has been location-based.

- **Scope 3**: Relevant to TCF's business were scope 3.1, 3.2, 3.5, 3.6, 3.7, 3.9 and 3.12. The remainder has been excluded from the analysis. The majority of emissions have taken place in TCF's value chain.

The 2023 Corporate Carbon Footprint (CCP) has been executed in Q4 of 2024 up till Q2 of 2025. Emission factors have been used and backed up by up-to-date sources. The organizational scope includes The Chocolate Family BV with all underlaying entities Art of Chocolate NL BV, Art of Chocolate GmbH, Ickx Verkoop NV, Chocolaterie Ickx NV, Rosenberg Import BV, Dragee BV. The Group's book year runs from May '23 to April '24.

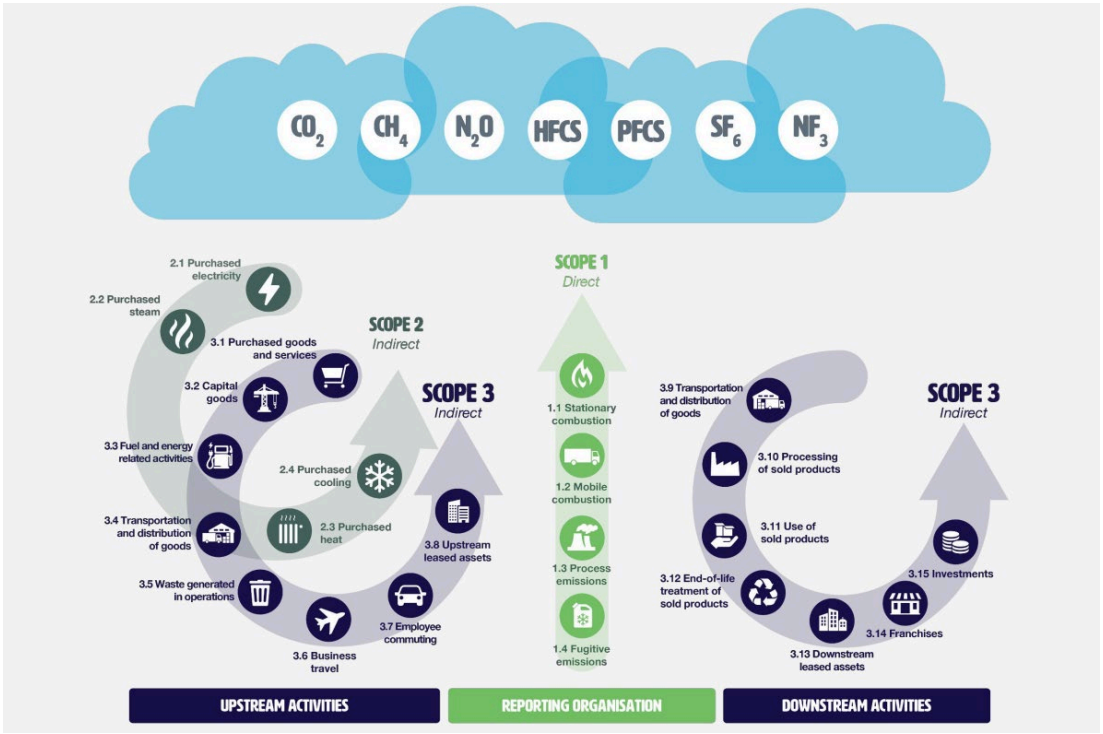

Figure 1. GHG-overview of Scopes

2023 results

The 2023 CCP has resulted in a total carbon footprint of **22.237,10 tCO2e**, which is split up in:

- **Scope 1:** 2001,02 tCO2e (8,6% of total)
- **Scope 2:** 2.679,84 tCO2e (11,5% of total)
- **Scope 3 upstream:** 18.331,64 tCO2e (78,7% of total)
  - **Of which FLAG** 14.477,21 tCO2e (62,2% of total)
- **Scope 3 downstream:** 279,96 tCO2e (1,2% of total)

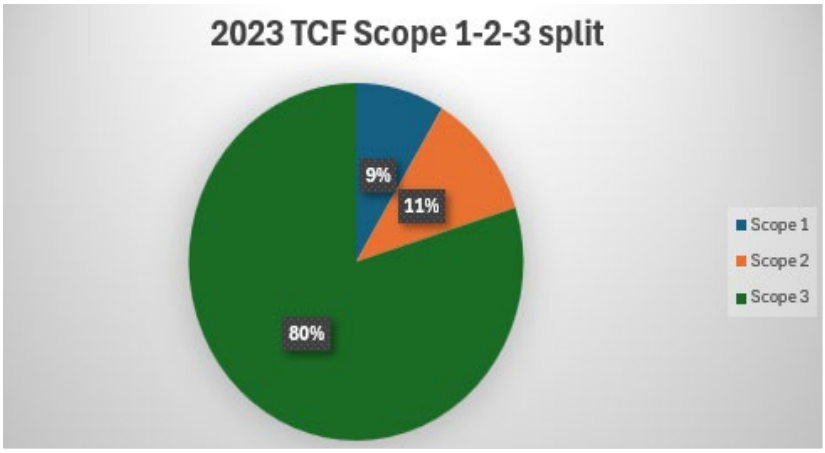

Figure 2. GHG Scope split

Figure 2 above shows the split between the different Scopes. Scope 1 being TCF's assets and the energy it needs in terms of natural gas, fuel for its car fleet and refrigerants for all cooling systems. Scope 2 is the electricity it requires to run its operations. Scope 3 is TCF's value chain, both up- &

downstream. Figure 3 below shows the more detailed activities, split amongst the GHG-scope within Scope 1, 2 and 3.

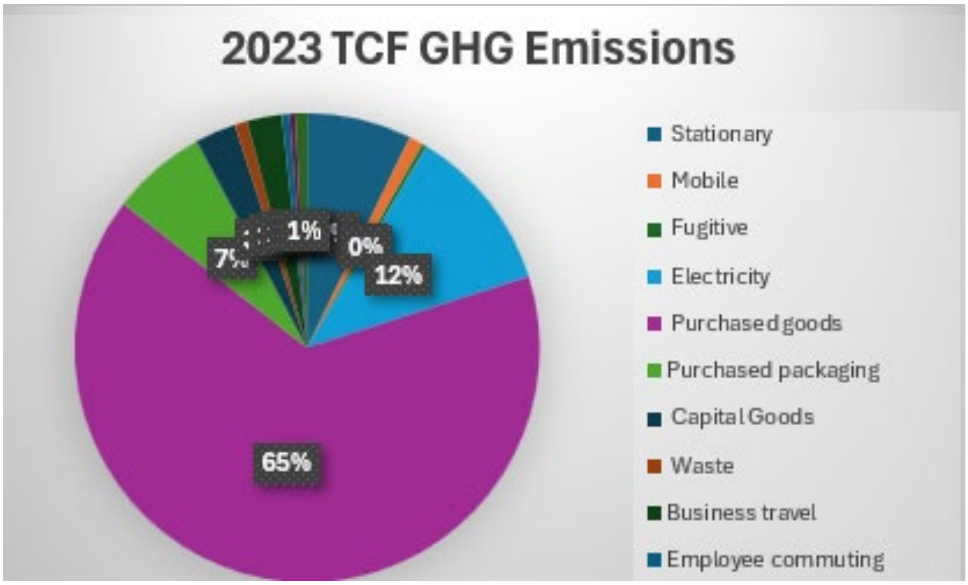

Figure 3. GHG split across Scopes

Scope 1 & 2 emissions; own operations

TCF's business model is energy intense in its own operations as it requires quite some electricity and natural gas to run its production lines and shops. Its 70.039 of M3 natural gas results in 5,3% of TCF's overall emissions, while its electricity demand of just over 5.000 MWh results in 12,1% of overall emissions. Electricity use has been measured by location-based emission factors (EFs). TCF's current energy contract is based on fossil fuels, and runs for another year without opportunities to switch to renewables and reduce emissions significantly. On a side note, there are two reduction strategies. One on energy efficiency and the other on emissions. The first requiring significant CapEx investments, while the latter requiring an increase in OpEx. Experience learns that by shifting to green energy contract and in parallel working on a more energy efficient operations (preventing spillage, managing peak demand etc), will drive down cost. TCF currently produces 1 KG of product with 1,69 KWh and 23,6 liters of natural gas. These intensity metrics are good internal starting points for reduction targets.

Interesting to note in the line of intensity metrics, a total amount of 1,69 liter of fresh water is required to produce 1 KG of final product.

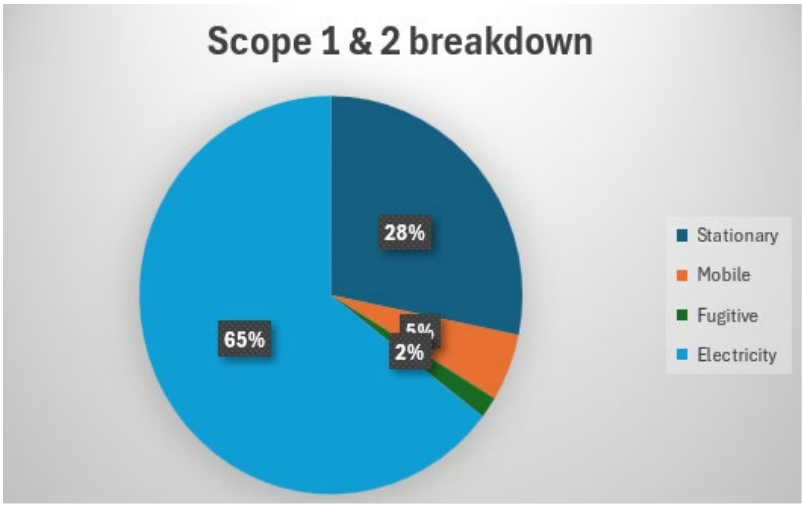

Figure 4. Scope 1 & 2 (own operation) breakdown

Beyond energy use, TCF has activities in 1.2 mobile emissions and in 1.4 fugitive emissions. On mobile emissions in 2023, a total of 1.175.355 kilometers have been driven by 39 people, on average this amounts to just over 30kKM a year. The average EF of all transportation here is 0,193, a mix of diesel, Euro 95, E10 and a few EVs. Even though this category amounts up to only 1% of total emissions, over time policy will drive this activity down by gradually switching to EVs over fossil fueled cars.
Fugitive emissions are 0,3% of total emissions, realized by approximately 35 liters of refrigerants added to TCF's cooling systems in 2023. Vichte's refrigerant spillage however has not been tracked, so the same as location in Essen has been used for this calculation. Details show that especially outdated refrigerants R-404A cause the emissions, with a very high EF due to the fact these are chemical and not natural refrigerants. Despite the low overall impact, gradually switching to newer cooling systems will automatically drive down this activity's relative impact.

Scope 3 emissions; value chain

Scope 3 emissions of TCF's value chain are most of their overall emissions, at a total of 79,9%. Upstream takes 78,7% and downstream the remainder of 1,3%.
Within Upstream, 'Purchased Goods & Services' take the largest share, as is custom in the food business. Followed the GHG-protocol a sub-activity for packaging has been created as 3.1b, while 3.1a consists of food-related purchases, with FLAG as non-FLAG activities included. On-farm activities (FLAG; Forest, Land and Argriculture) in the chocolate are relatively high, therefore take just over 65% of TCF's overall emissions. This means that if TCF wants to reduce its emissions both near-term as long-term in line with SBTi 1,5-degree pathway, it has to focus on these emissions at farm-level and work together with its value chain towards the grower to improve conditions.

The emissions from TCFs products have an origin in three volume streams; raw materials, packaging materials and finished products.
Raw materials have been calculated based on its supplier's emission calculator (source: Callebaut) for pure, white and milk chocolate. Other main ingredients like praline, caramel, and sugar have been calculated based on secondary EF data from CarbonCloud's Climate Hub. These measurements on ingredients covered 94% of total purchasing volume (at 2.35 million KG), after which the remainder has been extrapolated to get to TCF's total emissions.

The same has been done on packaging volumes, with a volume coverage of 75%. The third stream, that of finished products that are simply sourced and sold and not been further refined, have been measured on secondary data and extrapolated from 92%.
Even though secondary data has been used, the coverage of measured activities is relatively high and therefore the reliability of emission data for purchased goods is as well.

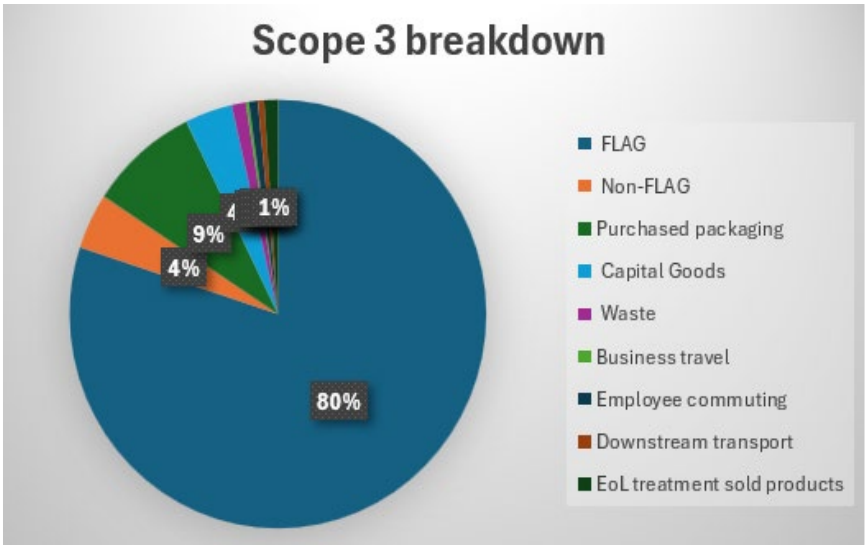

Figure 5. Scope 3 breakdown

Non-FLAG emissions have been based on industry averages. The Callebaut calculation tool doesn't split FLAG and non-FLAG emissions and EFs are from factory (cradle to gate) including all scope 1, 2 and relevant 3 from TCF's supplier of raw materials, Callebaut. Based on CarbonCloud's calculations from Belgian cradle-to-gate factory EFs, non-FLAG emissions are between 3-7% of total emissions, while the remainder is on farm-level. That's why we've taken a 5% assumption for non-FLAG Scope 3.1 emissions in this assessment. This can and must be further detailed in future steps, along with the collaboration with TCF's suppliers, including Callebaut, enabling better reduction strategies.

Beyond 3.1 F&B purchasing, 3.1b with Purchased Packaging is the third largest emission factor after 3.1a and electricity, just before natural gas use. TCF has bought just over 830 tKG of packaging products for its 15 million KG of products, resulting in 55 gram of packaging per KG product. Packaging consisted mostly of carton and paper (78%), while plastic used up 18% of total packaging materials. The remainder was used by aluminum (4%). Reduction strategies lay in the area of recycled paper use, if not already the case, reducing weight of primary and secondary packaging and shifting further away from plastics and aluminum, as the EFs are approximately twice that of paper per KG.
3.1b has a total of 6,6% of overall emissions, at 1.536 tKG CO2e.

Within the upstream value chain, four other activities cause emissions at TCF's operation, however all relatively small. Capital goods at Scope 3.2, has 2,9% of all emissions due to the fact TCF operates a total floor capacity (factory, offices and shops) at a total of just under 16.000 m2. The way this is measured, without spiking emissions upon new investments of premises, is a standard depreciation of initial emissions of new buildings over a period of 50 years (source: CE Delft, 2018). In addition to floor space emissions from its initial investment, also running year CapEx investments are taken into consideration. A total of just over 1.6 million has been invested across all business units, and have been rated via the DEFRA calculation method, all weighed at similar EFs per Euro investment.

Upstream transportation has not been calculated separately, as this has been included in the Callebaut and CarbonCloud measurements of farm to gate emissions. This is why 3.4 has no

emissions, while it is expected that from the 5% non-FLAG emissions of 3.1a, approximately 33% can be attributed to transportation, resulting in and around the 250-300 tKG CO2e, between the 1,5-2% of total emissions.

3.5 Waste has been calculated over all of TCF's premises, weighed by its waste collection partners and resulting in just under 200 tKG C)2e, at 0,9% of total emissions. On an intensity metric, this gives just under 60 grams of waste per KG produced. Only three waste streams are collected; residual (42%), paper (53%) and plastics (5%). One could say more waste streams could be detected, like organic waste from production resulting in a lower cost from residuals and a further value down the value chain if accommodated accordingly, whilst reducing emissions. This could be a point of attention in the reduction pathway, even though the total emissions of waste are relatively low (high effort, for low impact).

For 3.6 Business Travel, 266.098 KM has been traveled, of which 3% by train and the remainder mainly by plane. Average air travel distance was just under 3.300 KM, of which no trip was taken in business or first class. Like with waste, one could argue reduction measures by taking the train more often for <1000 or <750 KM distances, however this is at low impact and medium efforts. A total of 43 tKG CO2e was caused, at 0,2% of total emissions.

3.6b Visitor Travel to TCF's shops have not been taken along these calculations. No data for relatively accurate assumptions was available, so this is something TCF could pursue in the periods to come. Normally this category takes up quite some emissions, however there's little a company can do about it (efforts are high), while reliability of data is very low.

Employee Commuting under 3.7 has a total of 124 tKG CO2e, at 0,5% of TCF's total emissions. At an average distance of 28,4 KM one-way, with a weighed EF of KM traveled at 0,122, a total of just over 1 million KM has been traveled by 125 employees (who've taken a car to work). No data shows that employees come by means of public transportation or carpool to work. These – however with a low impact and relatively high effort – could be means of reductions going forward.

After producing all products, 3.9 Downstream Transport defines all transport from TCF to its first customer. A total distance of 760.763 KM has been traveled, 83% by truck over road and 17% by ship over sea. Industry average – secondary – emission factors have been used (source: CO2emissiefactoren.nl) as TCF's transportation partners were not able to provide their own data. In the future this should be part of the 'negotiations' allowing for improved and more sustainable means of transportation, both by truck and ship. Bear in mind any rectification of previous secondary data, by primary data later on, should be rectified in previous years. The upgrade to primary data is no reduction measure. The total emissions of this activity results in 88 tKG, or 0,4% of total emissions. This is relatively low as only the first customer has been measured, and not the final customer selling to the consumer. This is another improvement point, should data be available, in years to come. On average shipment travels 411 KM to reach its first customer, showing TCF operates in a fairly small area close to its base of operations.

The last area of activity and the second in TCF's downstream value chain, is the End-of-Life of its sold products. Because there's no exact data on volume sold in TCF's book year, the purchasing volume has been used in the same year and has been disposed of by consumers in the correct waste streams. We also assume that all waste has been disposed of in The Netherlands, as emission factor have been used from this country. In the future, more accurate data should be collected on what has been sold in terms of volume and in which country, allowing for more accurate analysis. However, the efforts by doing so are relatively high, including its assumptions, while the impact is relatively low. The total amount of KG discarded is 830 tKG, with an average EF of 0,231 (split amongst paper, plastic and aluminum), with a result of 192 tKG of emissions, or 0,9% of total emissions.

Looking at all the activities causing emissions for TCF, it is interesting to look at what this means per KG product. Figure 6 shows per KG of product where the emissions have originated from. Clearly – part of the cacao business in general – that emissions at origin on land are the majority. Energy and packaging come second and third, while all 'business operations' come split third at 7% of total with packaging. Transport, even though with some assumptions, is only a small portion of total emissions, as for waste.

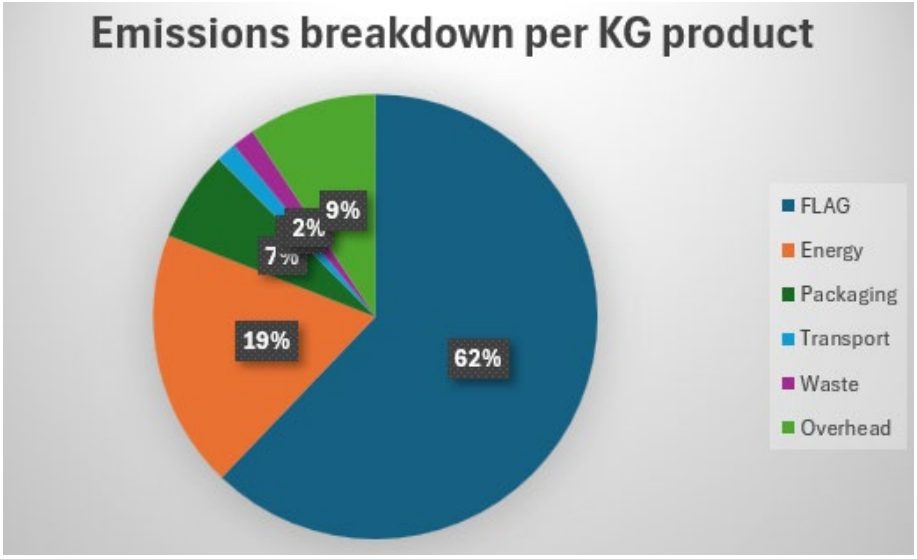

Figure 6. Emission breakdown per KG product

The emissions per EUR turnover and per KG product purchased are shown below:

- 0,54 KG CO2e / EUR turnover
- 7,86 KG CO2e / KG product

In future analysis, these intensity measurements can be compared to industry peers and intensity reduction targets can be set internally to measure progress.

Scope	Topic	Absolute in KG CO2e	Absolute in tCO2e	%	SUM in tCO2e	Reliability	Remarks
1.1	Stationary	1.701.141,07	1.701,14	7,3%		Good	Usage * EF country average
1.2	Mobile	227.266,78	227,27	1,0%		Good	Leased KM * EF
1.3	Process					N/a	
1.4	Fugitive	72.614,84	72,61	0,3%		Reasonably good	Reported spillage * EF (1/3 sites unknown; extrapolated)
Scope 1 total		**2.001.022,69**		**8,6%**	**2.001,02**		
2 - location based	Electricity	2.679.842,82	2.679,84	11,5%		Good	Usage * EF country average
2 - market based	Electricity					N/a	
Scope 2 total	*market based*	**2.679.842,82**	2.679,84	**11,5%**	**2.679,84**		
Scope 1 + 2 total		**4.680.865,51**		**20,1%**	**4.680,87**	Good	
3.1a	Purchased goods	15.239.166,92	15.239,17	65,4%		Reasonably good	Key SKU EFs per cat supplier (Callebaut) data, extrapolated to total
3.1a non-FLAG	*Non-FLAG*	*761.958,35*	*761,96*	*3,3%*		Reasonably good	Based on industry avg non-FLAG emissions of 5%
3.1a FLAG	*FLAG*	*14.477.208,57*	*14.477,21*	62,2%		Reasonably good	Based on industry avg FLAG emissions of 95%
3.1b	Purchased packaging	1.535.447,78	1.535,45	6,6%		Reasonably good	Key SKU EFs per cat secondary data, extrapolated to total
3.2	Capital Goods	665.753,01	665,75	2,9%		Reasonably good	M2 buildings and investments measured * secundairy EFs
3.3	Fuel & energy related		-	0,0%		N/a	
3.4	Upstream transport		-	0,0%		N/a	Included in 3.1 (factory level EFs, part of the 5% non-FLAG, assumed to be 1-2%)
3.5	Waste	198.302,79	198,30	0,9%		Good	Usage per waste stream * EF country average
3.6a	Business travel	568.224,07	568,22	2,4%		Reasonably good	All travel * EF
3.6b	Visitor travel		-	0,0%		N/a	
3.7	Employee commuting	124.745,54	124,75	0,5%		Reasonably good	All travel * EF
3.8	Upstream leased assets		-	0,0%		N/a	
Scope 3 - Upstream Total		**18.331.640,11**		**78,7%**	**18.331,64**		
3.9	Downstream transport	87.547,64	87,55	0,4%		Reasonably good	All shipments in tKG * KM * EF road and sea
3.10	Processing of sold products	-	-	0,0%		N/a	
3.11	Use of sold products	-	-	0,0%		N/a	
3.12	EoL treatment sold products	192.413,33	192,41	0,8%		Reasonably good	3.1b KG * EF household waste
3.13	Downstream leased assets	-	-	0,0%		N/a	
3.14	Franchise	-	-	0,0%		N/a	
3.15	Investments	-	-	0,0%		N/a	
Scope 3 - Downstream total		**279.960,97**	279,96	**1,2%**	**279,96**		
Total scope 3		**18.611.601,07**		**79,9%**	**18.611,60**		
SOM in KG CO2e		**23.292.466,59**		**100,00%**	**23.292,47**	Reasonably good	

Figure 7. Detailed breakdown of GHG CCP 202

This CCP has been a first for TCF, but all processes and assumptions have been templated so data retrieval can be done annually in the same way for sound comparison.

Going forward & conclusions

TCF is well positioned to drive down emissions as this is the initial measurement with no previous focus on reduction schemes yet. Going forward, the board will work together with Climates and its value chain partners to set clear targets, create a reduction pathway and align internal and external policies to enable emission reductions in line with the 1,5-degree pathway.

Using the 'impact-effort' analysis as a basis for reduction activities, below summary is a first step to achieve company strategy, policy and activities enabling emission reductions at its own operations as well as throughout its value chain. Below table shows the proposed activities, with Impact and Effort being rated from 1 to 5, 1 being small, 5 being large. Effort can mean both financial, resources or difficulty. Impact means how much reductions this activity can bring potentially, as part of TCFs total emissions.

Scope	Activity	Impact	Effort
3.1 FLAG	Value chain transparency & traceability to the farmer and work with all value chain partners to primary data and act on more sustainable farming practices	5	4
3.1	Switch to more sustainable raw materials (Rain forest alliance chocolate)	5	4
1.1 & 2	Change energy contract to 'green'	4	2
1.2	Create policy and gradually change to driving EVs	1	2
3.1b	Deep-dive into recycled materials and reduce weight of packaging	3	3
3.5	Measure organic waste, and work towards more waste streams to upcycle them	2	2
3.6b	Start measuring visitor travel by researching how customers come to TCF's stores	3	3
3.7	Create policy to stimulate public transportation, carpooling and emission free transport.	1	3
3.9	Work with transportation partners for primary data and evaluate HVO and EV transport	1	3
3.12	Work on more primary data	1	2

Scope 1 and 2 emissions can quite easily be reduced in line with the 1,5-degree pathway by switching to renewables, and reaching carbon neutrality in TCF's own operation. Cooperation along the value chain will be essential, with both TCF's strategic suppliers to get more primary data, as well as with transportation partners to further reduce emissions from farm to fork. And in the end, transparency, and cooperation with and from retailers is essential to translate the value of sustainable, tasty chocolates to its shoppers.

Analysis performed over the period Q4-24 up and until Q1-25.