apparel impact institute

Taking Stock of Progress Against the Roadmap to Net Zero *2024*

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WEBSITE
apparelimpact.org

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@apparelimpactinstitute

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Foreword

In June of 2019, at the Sustainable Apparel Coalition[1] annual meeting in Barcelona, Apparel Impact Institute (Aii) co-convened a workshop with World Resources Institute (WRI) on the occasion of the publication of apparel sector guidance for setting science-based climate change targets (SBTs). At the time, roughly a dozen apparel companies had targets approved by the Science Based Targets initiative (SBTi), and the intent of the guidance was to bring clarity and consistency to the target setting process. The guidance provided a blueprint for apparel companies to set SBTs, though the sector needed to align on how to deliver the needed greenhouse gas reductions. The "how" was the focus of the Barcelona workshop.

Over the next 18 months, Aii and WRI evaluated how the sector could deliver the needed reductions, and published their findings in 2021.[2] In that report, Aii and WRI identified six levers for reducing emissions, and provided an estimate of sector greenhouse gas (GHG) emissions based on data from Textile Exchange, Worldly, and Cascale. We promised to refresh the analysis annually using the best available data, and we published the first refresh in 2023.[3] This paper is the second refresh of our analysis, based on data for 2022.[4]

In 2024, there are daily headlines about the negative impacts of climate change on people and the planet. Atmospheric concentrations of carbon dioxide emissions hit a record high in 2023 — double pre-industrial levels. In April, intense heat waves occurred in India, Thailand, and Bangladesh, and fatal flooding impacted China and Pakistan. Heat-related deaths in Europe are up 30 percent over the last twenty years. Sadly, the negative impacts predicted by scientists decades ago are upon us.

Despite these negative headlines, there are reasons for optimism — particularly in the apparel sector. There are now over 500 apparel, footwear, and textiles companies with approved science-based targets or commitments to set them according to the SBTi. Unlike the dozen companies that had approved targets in 2019, these span the world and value chain, including many manufacturers and material suppliers. Companies have a solid understanding of where hotspots of emissions lie, and are investing resources — technical and financial — to reduce emissions. Aii's latest annual report profiles some of these companies and initiatives.

In this paper, you will see that 2022 emissions for the apparel sector declined 1.17 percent from 2021. This is a welcome development, yet we know that we need to reduce emissions much further to stay within a 1.5°C trajectory and avoid the worst impacts of climate change. Aii and its lead partners have set an ambitious goal: to enable the reduction of apparel sector emissions by 100 million tonnes (Mt) by 2030. The $250 million Fashion Climate Fund is engineered to unleash $2 billion in blended capital, propelling "tip-of-the-spear" activities that showcase scalability within the industry. The Climate Solutions Portfolio is a registry of programs and solutions that must be replicated. According to this report's latest analysis, a reduction of 100 Mt constitutes approximately 11 percent of 2022 emissions. While significant, we urge all actors in the apparel value chain to unite with us, committing resources to usher in a net-zero future.

Lewis Perkins
President, Aii

Michael Sadowski
Advisor, Aii

1 The Sustainable Apparel Coalition rebranded as Cascale in February 2024.
2 *Roadmap to Net Zero: Delivering Science-Based Targets in the Apparel Sector*, World Resources Institute, Apparel Impact Institute, November 2021.
3 *Taking Stock of Progress Against the Roadmap to Net Zero*, Apparel Impact Institute, June 2023.
4 Due to time lag in data collection, the *Roadmap to Net Zero* is based on 2019 data from Textile Exchange, while *Taking Stock of Progress* is based on 2021 data.

1. Report Highlights

- Based on data from Cascale, Worldly, and Textile Exchange, we estimate apparel sector emissions to be 0.879 gigatonnes (Gt) of carbon dioxide equivalent (CO_2e) in 2022. This represents roughly 1.85 percent of annual global GHG emissions.[5]
- This represents a decrease of 1.17 percent from the 2021 estimate presented in *Taking Stock of Progress Against the Roadmap to Net Zero*.[6]
- Assuming business-as-usual growth for the apparel sector, emissions are projected to be 1.243 Gt in 2030. To stay within a 1.5°C trajectory (45 percent reduction by 2030), the sector would need to reduce emissions from 0.879 Gt in 2022 to 0.489 Gt by 2030.
- The breakdown of emissions across the value chain for 2022 is similar to the previous two reports.[7] Material processing (Tier 2) is highest at 55 percent of total emissions, followed by raw materials (Tier 4) at 21 percent, raw materials processing (15 percent), and finished goods assembly (9 percent).

5 Global GHG emissions data for 2020, which is the most recent estimate from World Resources Institute (accessed on May 14, 2024).

6 *Taking Stock of Progress Against the Roadmap to Net Zero*, Apparel Impact Institute, June 2023.

7 *Roadmap to Net Zero: Delivering Science-Based Targets in the Apparel Sector* (November 2021) and *Taking Stock of Progress Against the Roadmap to Net Zero* (June 2023).

2. Context

In June 2023, Apparel Impact Institute (Aii) published *Taking Stock of Progress Against the Roadmap to Net Zero ("Taking Stock")*, which was a follow up to the November 2021 publication from World Resources Institute (WRI) and Aii entitled *Roadmap to Net Zero: Delivering Science-Based Targets in the Apparel Sector ("Roadmap")*. As described in the *Roadmap*, when WRI and Aii published the inaugural report, the intent was to refresh the calculation of apparel sector GHG emissions on an annual basis, factoring in any key revisions in the underlying data and assumptions. Aii's annual stocktake is intended to enable the industry to gauge progress on its collective goal to reduce emissions by 45 percent by 2030 (from 2019 levels).

With this report, Aii provides an estimate of GHG emissions for 2022 using fiber volume data from Textile Exchange for 2022 and GHG impact data from the Higg Material Sustainability Index (MSI). As with the previous two reports, Aii based its analysis on what we believe to be the most widely used and representative data in the apparel sector — fiber volume data from Textile Exchange and GHG impact data from the Higg MSI, a product of Cascale and Worldly.

BOX 1
STATE OF SCIENCE-BASED TARGETS IN THE APPAREL SECTOR: APRIL 2024

As of April 2024, there were over 500 apparel, footwear, and textiles companies with approved science-based targets or commitments to set them, according to the Science-Based Targets initiative. This is a significant increase from the roughly a dozen companies with approved targets or commitments in June 2019 when the SBTi published its apparel sector guidance, and from the 300 companies in June 2023 when we published *Taking Stock*.

The current list of apparel, footwear, and textiles companies with approved targets and commitments can be found on the SBTi website: sciencebasedtargets.org/companies-taking-action

3. Methodology: Calculating Apparel Sector GHG Emissions

In calculating apparel-sector GHG emissions for 2022, Aii took the same approach as taken in the *Roadmap* report.

We started with fiber weight[8] data compiled by Textile Exchange in their *Materials Market Report 2023* (published in December 2023). This covers global production weights of the various fibers and materials used in textiles in 2022. For each fiber type, we used Textile Exchange assumptions on the percentage of all fiber that is used in apparel versus other categories such as home textiles, as shown in Table 1.

TABLE 1: FIBER ALLOCATION TO APPAREL

Fiber	Percentage Allocation to Apparel
Cotton	70%
Wool	45%
Down	25%
Viscose	50%
Lyocell	50%
Modal	50%
Polyester	55%
Nylon	46%
Acrylic	75%
Elastane	67%
Polypropylene	67%
Hemp	1%
Flax	60%
Silk	90%
Alpaca	95%
Jute	1%
Acetate	5%

8 We use "weight" in this document for consistency with the Roadmap report. Textile Exchange uses "volume" in their *Materials Market* report.

For each fiber type, we multiplied the allocated total fiber weight by the GHG emissions factors for each process stage in the MSI:

Raw material, for example cotton farming to gin

Yarn formation, or spinning fiber into yarn

Textile formation, for example knitting or weaving yarn into fabric

Preparation, for example scouring

Coloration

Additional coloration and finishing, including heat setting

Since the MSI does not include data on finished goods production (Tier 1), we used a simplified process from Quantis' World Apparel & Footwear Life Cycle Assessment Database (WALDB) as a proxy. As with the previous reports, we excluded emissions from the following sources because they are minimal and / or difficult to estimate. See the *Roadmap* and *Taking Stock* reports for further explanation.

Corporate offices and other buildings

Consumer use

End of life

Downstream transportation

Our calculations use refreshed MSI data, the details of which can be viewed in the change log for Version 3.7 (December 2023). As described in the change log, all global warming midpoints and scores have changed due to the update to the LCA for Experts (formerly known as GaBi) database. Some notable revisions include:

Global warming potential calculated using the IPCC AR6 method, which includes small revisions from the IPCC AR5 method.

PET – all impact areas have changed due to an update in the background dataset for a precursor material.

Nylon – all impact areas have changed due to a correction in the background dataset to better reflect current industry practices.

Spandex fiber (the LYCRA Company) – all impact areas have decreased due to background database update in polyol dataset.

3.1 Key Assumptions and Limitations

3.1.1 Raw material extraction

SCOPE: **Emissions related to extracting fossil fuels for conversion into synthetic fibers and growing natural fibers such as cotton and wool.**

According to the *Materials Market Report 2023*, roughly 116 Mt of fiber were produced for textiles in 2022, which is double the amount of fiber produced in 2000 (58 Mt). Based on the fiber percentage allocations shown in Table 1, the starting point for fiber used in apparel was 63.9 Mt of fiber, which is an increase of 3 percent from 2021.

Polyester was the most used fiber type in 2022, representing 54 percent of total global fiber production, with cotton second at 22 percent, followed by man-made cellulosic fibers (MMCF) at 6.3 percent, and nylon at 5 percent (all of these percentages were essentially the same in 2021). Aii's analysis excludes leather as we only evaluated apparel (and not footwear) and the MSI does not have data on production processes for leather apparel.

For Tier 4, we multiplied the weights of each fiber type by the corresponding emissions factor from the MSI and summed these for the Tier 4 figure.

3.1.2 Raw material processing

SCOPE: **Spinning fiber into yarn.**

Our analysis focused on spinning fibers into yarn and did not include the processing of other intermediate materials, such as metal for zippers, as that data is not readily available. Our goal is to include more of these trims and other inputs in future analyses.

As with the two previous reports, we made the following assumptions for converting fiber into yarn:

TABLE 2: ASSUMPTIONS FOR YARN TYPES

Fiber	Assumptions
Polyester	67% filament yarn 33% staple fiber ring spun yarn
Nylon	90% filament yarn 10% staple fiber ring spun yarn
Polypropylene	60% filament yarn 40% staple fiber ring spun yarn
Acrylic	100% staple fiber ring spun yarn
MMCF (Viscose Rayon, Modal, Lyocell)	100% staple fiber ring spun yarn
Cotton	75% staple fiber ring spun yarn 25% staple fiber rotor spun yarn
Wool	100% staple fiber ring spun yarn

We assumed yarn density of 200 decitex for all fiber types, and used the same fiber loss rates as we did in the *Roadmap*.

3.1.3 Material production

SCOPE: **Textile formation, preparation, coloration, and additional coloration and finishing.**

Our analysis for Tier 2 covered:

- Textile formation (knitting or weaving yarn into fabric)
- Preparation, such as scouring
- Coloration
- Additional coloration and finishing, such as heat setting

We assumed 40 percent knit and 60 percent woven for all fiber types for textile formation. For preparation, we applied default MSI emissions factors for each fiber type. The sources for these emissions factors can be found in the public version of the MSI. For coloration, the default MSI emissions factors were again applied for each fiber type:

- Synthetic fibers: Batch dyeing with disperse or cationic dyes
- Cotton and MMCF fibers: Batch dyeing with direct, sulfur, vat, or reactive dyes
- Wool: Batch dyeing with acid dyes

Companies wanting to refine their analysis can select specific coloration methods in the MSI.

As with Tier 3, calculations use fiber loss rates from the MSI (via Textile Exchange) for Tier 2.

3.1.4 Finished goods manufacturing

SCOPE: **Final assembly of products, including cutting and sewing of fabric into garments.**

As with the *Roadmap*, we calculated finished goods manufacturing emissions using a standard emission factor per kilogram of finished product using data from Quantis' WALDB. The process includes GHG impacts from electricity consumption (80 percent of the GHG impact), thermal energy, and minor sources such as tap water. Calculations used the electricity mix representing the top apparel manufacturing countries, which is consistent with the MSI.

In our calculations, we assumed an average fabric loss rate of 20 percent for finished goods.

The Results

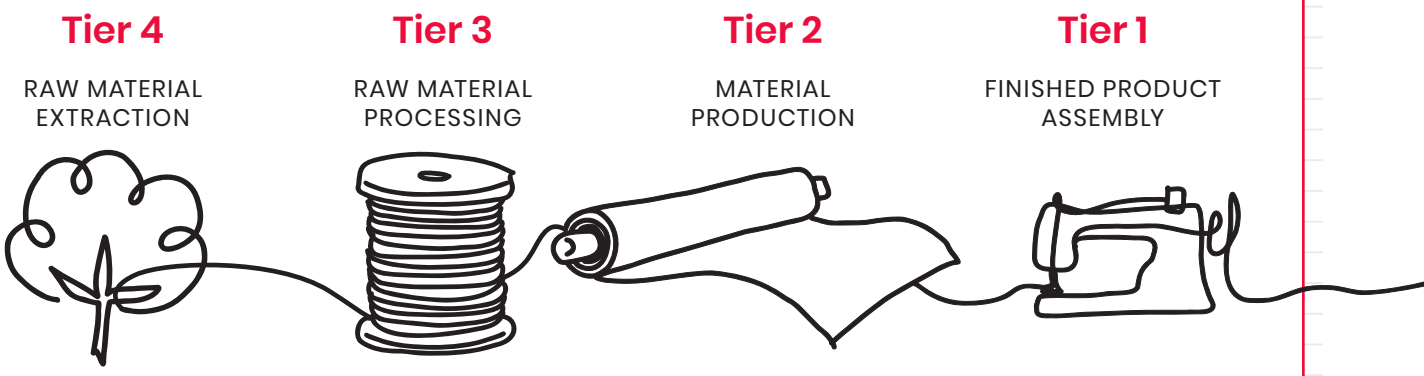
Given the above assumptions, we estimated total apparel sector GHG emissions for 2022 to be 878.7 Mt CO_2e, or 0.879 Gt. This is a decrease of 1.17 percent from 2021, which was driven primarily from an improvement in the raw material GHG intensity for polyester and nylon.

Based on global annual GHG emissions of 47.5 Gt, the 2022 figure represents roughly 1.85 percent of global GHG emissions.[9]

The percentage breakdown of emissions across the value chain was nearly identical to 2021, as illustrated in figure 1.

FIGURE 1: 2022 EMISSIONS BREAKDOWN ACROSS TIERS

Total Apparel GHG Emissions: 878.7 Mt CO_2e (0.879 Gt)



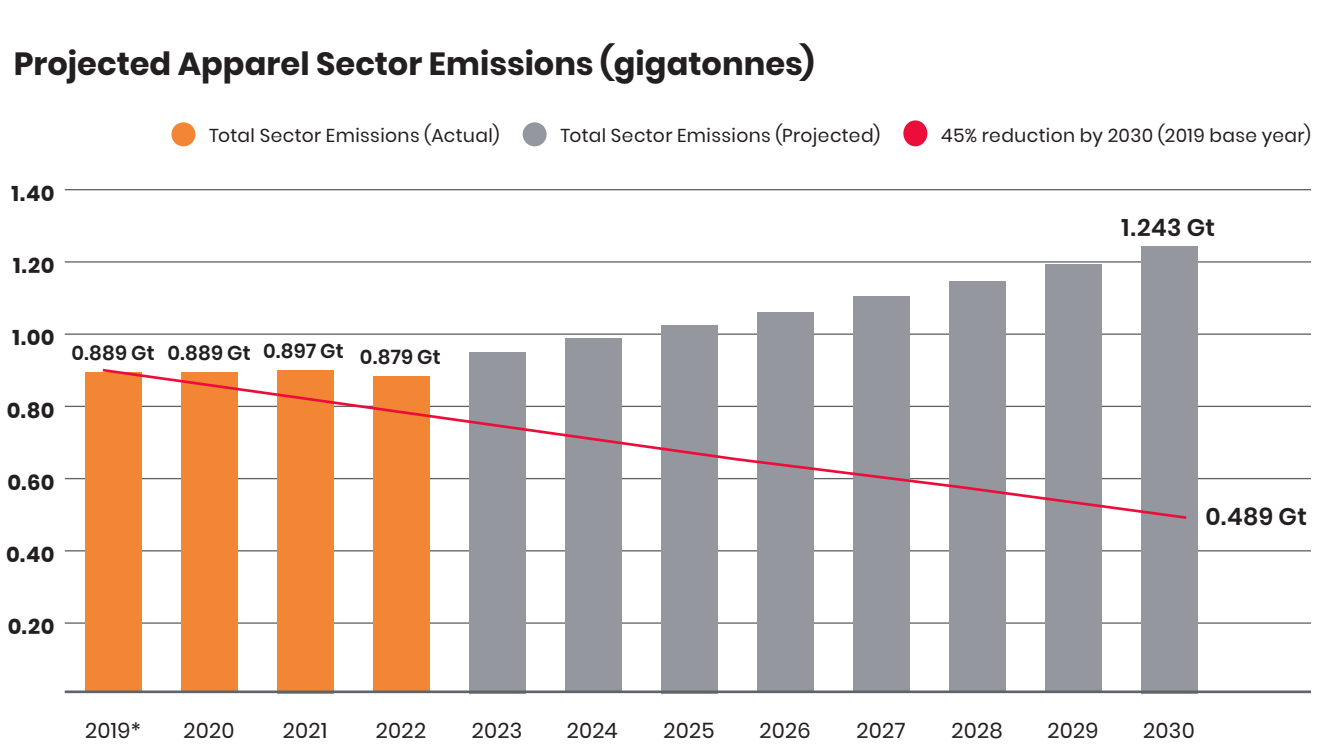
Tier 4	Tier 3	Tier 2	Tier 1
RAW MATERIAL EXTRACTION	RAW MATERIAL PROCESSING	MATERIAL PRODUCTION	FINISHED PRODUCT ASSEMBLY
Cultivation and extraction of raw materials from the earth, plants, or animals	Processing of raw materials into yarn and other intermediate products	Production and finishing of materials (e.g. fabric, trims) that go directly into finished product	Assembly and manufacturing of final products
188Mt Co_2e	**134Mt Co_2e**	**482Mt Co_2e**	**75Mt Co_2e**
21%	**15%**	**55%**	**9%**

9 Global GHG emissions data for 2020, which is the most recent estimate from World Resources Institute (accessed on May 14, 2024). Note there is a time lag on the global GHG figure.

As we noted in our previous reports, given the state of impact data in the apparel sector, we refer to our result (0.879 Gt) as a reasonable but not definitive estimate of apparel sector emissions. We believe our result is the best estimate of sector emissions, and we will continue to work on gathering better data so that we can refine our calculations in the future.

Assuming business-as-usual growth for the sector, emissions are projected to be 1.243 Gt in 2030. This reflects annual growth rates of 5 percent for synthetics and MMCF and 1 percent for cotton and other natural fibers.[10] To stay within a 1.5°C trajectory — achieving 45 percent reduction by 2030 — the sector would need to reduce emissions from 0.879 Gt in 2022 to 0.489 Gt by 2030, and even more if we are to achieve net zero by no later than 2050.

FIGURE 2: PROJECTED GHG EMISSIONS FOR THE APPAREL SECTOR, 2019–2030



* We recalculated the 2019 emissions figure using the revised fiber allocation percentages from Textile Exchange, though we used the MSI emissions factors from the Roadmap. The revised calculation for 2019 has therefore changed from 1.025 Gt to 0.889 Gt CO_2e

10 We base this assumption on data from Fiber Year Consulting and previous stakeholder feedback. WRI and Aii used the same assumption in the *Roadmap*.

4. Looking Ahead

The data is clear: While the apparel industry is making progress, the pace of change is far short of what is needed to meet our ambitious climate targets. We must set bold emissions reduction goals and we must act now.

In recognition of this urgent need, Aii has committed to enabling the reduction of 100 Mt CO_2e emissions by 2030. We are actively rallying industry leaders to pool $250 million in catalytic capital to create a robust inventory of solutions and attract necessary climate finance. Most importantly, over the next six years, we will engage with 2,000 suppliers across key production regions to offer comprehensive support, including technical assistance, sustainable finance options, and access to the best available technologies.

While we firmly believe in the importance of our work, we acknowledge that achieving net-zero requires a collaborative effort beyond a single organization. We call upon all stakeholders across the value chain to unite with us by committing resources to scale and implement impactful solutions that drive tangible emissions reductions.

ABBREVIATIONS:

CO_2e: Carbon Dioxide Equivalent

GHG: Greenhouse Gas

Gt: gigatonnes (1 billion tonnes)

Mt: Megatonnes (1 million tonnes)