TEXTILE RECYCLING INTERNATIONAL

Return, Renew, Reuse, Recycle

TEXTILE RECYCLING INTERNATIONAL (TRI) GROUP'S CARBON FOOTPRINT

2022/23 Greenhouse Gas Inventory and Comparative Assessment **MAY 2023**

TRI Group contacted Eunomia to undertake an independent greenhouse gas inventory and comparative assessment for 2022.

2022 Greenhouse Gas Inventory

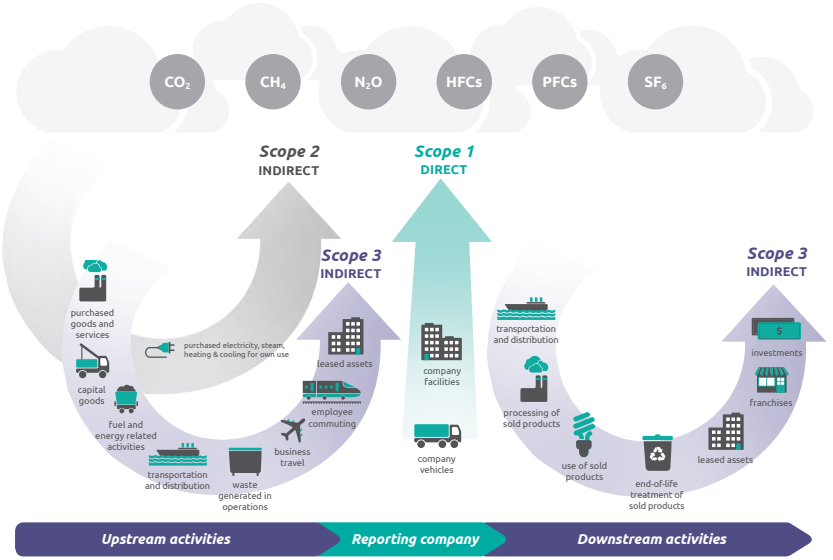
What have we measured?

An organisational Greenhouse Gas Inventory calculates the amount of greenhouse gas emissions a company is responsible for in a given period. TRI Group undertook work to calculate its impacts following the international standard developed by the GHG Protocol. Using this method, GHG Inventories are split into Scopes:

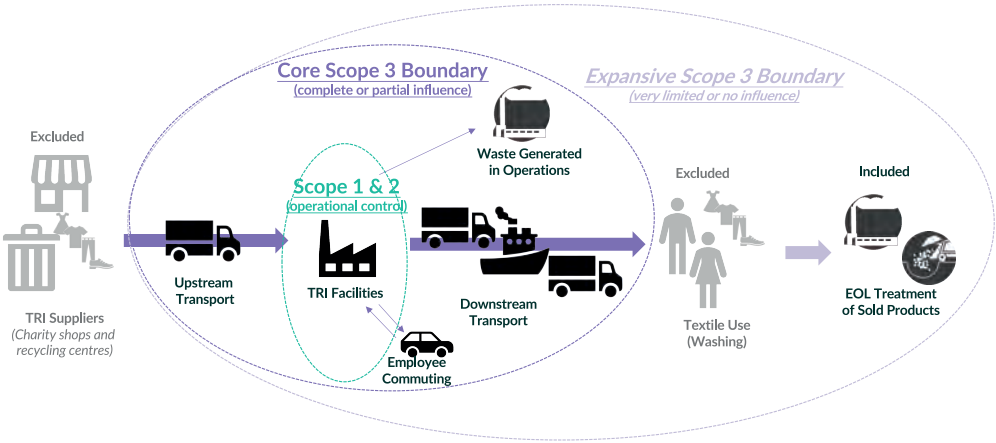
- Scopes 1 & 2 cover all the activities that TRI Group has direct control over, and
- Scope 3 covers the activities that occur within TRI Group's supply chain (both upstream and downstream) which, while TRI Group may not be able to control directly, it has some level of influence over.

The diagram below has been taken from the GHG Protocol's Corporate Value Chain (Scope 3) Standard, and demonstrates all the emission sources that could comprise a company's Scope 1, 2 and 3 GHG Inventory.

Figure [1.1] Overview of GHG Protocol scopes and emissions across the value chain



Not all of these Scope 3 categories are relevant to TRI Group. In some cases, TRI Group does not have any activities in that area (e.g. Franchises). In other cases, we have excluded categories because TRI Group has minimal influence over emission reduction activities (e.g., Use of Sold Product). The diagram on the right summarises which activities have been measured within the Scope 3 boundary.



*Results for an **expansive** Scope 3 boundary (including EOL Treatment of Sold Products) have been calculated for the sake of transparency and future compliance. However, it should be noted that results for a **core** Scope 3 boundary have also been presented separately as they are considered to be more strategically important for TRI Group (this is discussed in more detail below). Three activities are discussed below to explain the logic of their inclusion/exclusion:*

- **TRI Group Suppliers:** Because TRI Group purchase donated textiles that would otherwise be disposed of, these textiles have been considered as a by-product and effectively come 'burden-free' (in respect of upstream manufacturing emissions) to TRI Group (at the point of collection). This approach follows the treatment of waste products in the Product Life Cycle Accounting Reporting Standard1.

- **Textile Use:** For clothing manufacturers, Science Based Targets Initiative (SBTi) recommends that the impacts from washing (predominantly impacts from water heating and detergent manufacture) are an optional category to include within the scope of the inventory emission reduction targets2. Given TRI Group (as a reuse organisation) has no influence over the composition or labelling of the textiles it receives (the few ways that manufacturers can influence washing impacts), these impacts have not been included.

- **End-Of-Life (EOL) Treatment of Sold Products:** The impacts of the waste management processes used to treat textiles at their EOL (GHGs released as textiles degrade in landfill or are incinerated) are also included within an expansive Scope 3 boundary. While TRI Group has limited influence on how consumers dispose of its reused textiles, or how waste management businesses treat textiles at EOL, there is some influence in terms of which regions the goods are being sold, which greatly impacts the intensity of waste treatment impacts.

TRI Group intends to continually review its operational boundary in future years, with respect to confirming which categories are included or excluded.

Climate Impacts which fall outside a GHG Inventory

The emissions avoided due to TRI Group preventing the production of new textiles through reuse and recycling cannot be accounted for under the GHG Protocol: Corporate Accounting and Reporting and SBTi: Net Zero standards. However, these impacts are very significant and a key environmental benefit of reuse.

The delayed carbon release due to clothing (particular natural fibres) being kept out of landfill for longer is not included as GHG Accounting typically operates on a 100 -year (sometimes 20-year) period, during which we would assume the clothes will be disposed of (i.e., after reuse). However, in the context of an imminent climate crisis, delaying emissions for three years (the lifetime of a reused garment) is still beneficial.

Data Quality

The secondary data used was sourced largely from the UK Government approved Greenhouse Gas Reporting: Conversion Factors 2022; the exception being the impacts from EOL Treatment of Sold Products, which were calculated using Eunomia's used in-house waste treatment modelling tool, which has been used on several national and European Commission GHG Impact Assessment projects. The primary data (i.e. data that is specific to TRI Group) used to calculate our inventory has been assessed below in terms of data quality.

Emission Source	Data Quality	
Upstream Transport	★★★	Primary fuel data on litres by all suppliers
Own Operations	★★★	Primary data on electricity and gas use for all TRI Group facilities, as well as primary fuel data for owned vehicles
Employee Commuting	★★★	Survey data on transport modes and car-sharing practices of all employees was combined with employee postcode data (for calculating distances to work)
Downstream Transport	★☆☆	Average routes were estimated based on primary data for on total tonnage freighted to each country of sale.
Waste Generated in Operations	★★☆	Currently an expert judgement of 3% of received goods assumed as waste (due to contamination before collection)
End-of-Life Treatment of Sold Products	★★☆	A combination of primary and secondary data was used to perform a compositional analysis, then a regionally-specific waste modelling tool was developed to model the impacts from landfill and incineration – before which regional averages were assumed for the split between landfill and incineration.
Displacement Effect	★☆☆	We have used industry average data provided by WRAP to calculate the avoided emissions due to displaced virgin clothing (discussed further in the Quantifying Displacement section below.

Actions for on-going improvement of primary data quality:

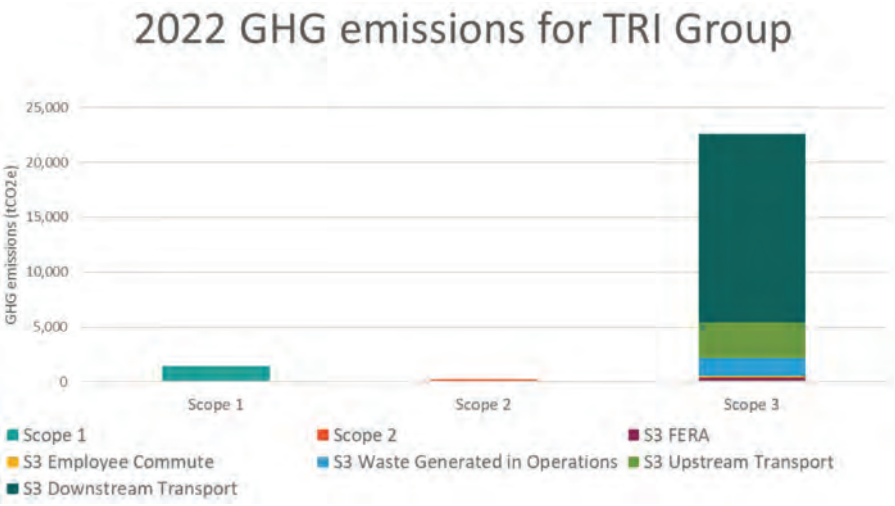
- **Downstream Transport:** More detailed route mapping, including a separate investigative study into the movement of textiles after being received by the destination port.
- **Waste Generated in Operations:** Collecting primary data on waste tonnages from waste contractors.
- **EOL Treatment of Sold Products:** Expand on existing compositional analysis (continuing our work with the Sorting for Circularity project). Develop more specific regions for waste impact modelling and more specific waste processing technology assumptions within those regions.

Results

Emissions from TRI Group's own operations (Scope 1 & 2) for FY2022 have been measured at 2,000 tCO2e – that's the equivalent of the average annual impact of 445 cars driven for one year[3].

TRI Group's Scope 1, 2 and 3 emissions have been measured at 24,000 tCO_2e the equivalent of 5,340 cars driven for one year - or 176,000tCO_2e and 39,165 cars if the EOL Treatment of Sold Products is included.

Results have been separated out by emission category below. GHG emissions from EOL Treatment of Sold Products have been excluded from the chart but included in the data table for practical reasons (i.e., the readability of the bar chart).



Primary Data Source	Emissions Category	Consumption Type	Emissions CO2e (tonnes)
Core Fuel and Energy	Scope 1	Stationary	577
Core Fuel and Energy	Scope 1	Mobile	1,079
Core Fuel and Energy	Scope 2	Stationary	307
Core Fuel and Energy	Scope 3 Fuel and Energy-Related Activities	(all)	457
Contractor Fuel Data	Scope 3 Upstream Transport	Mobile	2,646
TRI calculations	Scope 3 Employee Commute	Mobile	366
Sales	Data Scope 3 Downstream Transport	Mobile	18,693
Sales	Data Scope 3 Waste Generated in Operations	Stationary	1,861
Sales	Data Scope 3 End-Of-Life Treatment of Sold Products	Stationary	150,321

The results confirm that Downstream Transport (mainly shipping textiles internationally) represents the most significant source of GHG emissions; this will be similar in impact intensity to the shipping of new clothing. Upstream Transport (driving textiles from suppliers to TRI Group facilities) was identified as the second most important emission source. Waste Generated in Operations was also calculated as having significant impacts. When extending the operational boundary to include the EOL Treatment of Sold Products, this becomes by far the most significant impact (representing 85% of all total impacts); this impact is particularly large given the relatively high carbon-intensity of disposing of clothing in developing countries (which has been assumed to occur largely via landfills with no gas capture technology). The EOL impacts will be similar for new and used clothing.

TRI Group hopes that by publishing its results in a transparent manner, other businesses involved in the reclamation, processing and recycling of used clothing will be encouraged to publish their results – which will eventually allow for benchmarking once harmonisation of accounting methodologies is established within the industry.

Comparative Assessment

Alongside calculating our GHG baseline, we undertook a comparative assessment to identify how TRI Group's process (sorting used textiles and shipping to other countries for reuse) compares to the other key EOL routes for textiles used in the UK: incineration and landfill. This assessment was driven by third party commentary intimating incineration, or even landfill in the UK results in less GHG emissions than an international reuse model.

For the purpose of this assessment, the 'TRI Group scenario' GHG emissions can be represented as follows:

A – B + C, where:

- A = TRI Group's 2022 'core' GHG emissions (excluding EOL Treatment of Sold Products)
- B = Avoided GHG emissions due to TRI Group diverting clothing from landfill/incineration and preventing the production of new textiles through reuse and recycling
- C = GHG emissions resulting from the EOL Treatment of Sold Product

The Displacement Effect

The concept of displacement is essential when measuring emissions and avoided emissions from reusing or recycling used clothing.

Within circular economy thinking, we assume that some purchases of reused clothing displace the purchase of a new/virgin clothing that would otherwise have occurred, and therefore the emissions associated with the production and disposal of that new clothing are avoided. The displacement rate is almost always assumed to be less than one-for-one. For example, a displacement rate of 40% means that for every 10 reused garments purchased, they would only be displacing the impacts associated with manufacturing 4 new garments – for example, because they may not last as long as a new garment, or it could have been a 'spur of the moment purchase' that wasn't actually needed.

(Note this effect has not been considered in the GHG Inventory above).

Quantifying Displacement

When attempting to quantify the impacts of the displaced primary textiles in the end-market there are two key variables that are needed, for which there is unavoidably a high degree of uncertainty.

1) Quantifying the Displacement Rate

The central-case values for the displacement rate we have used are those suggested as part of the Sustainable Clothing Action Plan (SCAP) 2020 Commitment4. We have then established best and worst case (from TRI Group's perspective) values by multiplying by a factor of 2 (these will inform the error bars in the final results).

Displacement Region	Worst-case	Central-Case	Best-Case
Domestic	15%	29%	58%
Eastern Europe	5%	10%	20%
Africa	15%	30%	60%
Rest of World	5%	10%	20%
Sale as Wipers	40%	80%	100%
Sale as Insulation	34%	67%	100%

We believe we have chosen conservative values for the central-case displacement rate, as many other sources suggest displacement rates of 60% or higher for reused clothing[5,6]. On the other hand, we recognise that many studies have found that a lot of used clothing that is sold internationally (as much as 40%[7]) is actually unsuitable for reuse. This means that, instead of displacing new products, it is immediately sent for disposal on arrival in the importing country. We believe this issue is overwhelmingly caused by unscrupulous textiles exporters who do not adhere to any collection and sorting standards, simply selling bales of unsorted clothing at a much lower value than TRI Group, which actually contains products unfit for sale, for example wet/stained/damaged textiles, or even other contaminants like food waste.

2) Quantifying the Impact of New Textiles

We have calculated the impact of producing new clothing using background data to the Textiles 2030 Footprint Calculator v2.16 (also part of the SCAP project) of **21.46 kg CO_2e per kg of clothing**[8]. This figure represents the average carbon footprint of producing 1kg of textiles, averaged across all fibres and garment types, based on WRAP's internal studies, updated with data from SCAP members. Emission factors for wipers and insulation – which relate to the benefits obtained when textiles are recycled into those products - have been obtained from academic literature[9] and an LCA database[10] respectively.

	Emission Factors (kgCO2e/kg)		
	Worst-case	Average	Best-case
New/virgin clothing sold	13.5	21.46	33.9
New/virgin wipers sold	4.3	4.3	4.3
New/virgin insulation produced	[license required to access figures]		

While this number has a high degree of uncertainty associated with it, a value of 21.46 sits comfortably within the range of values reported by WRAP over various studies, and within range of 15-35kg CO2e/kg reported by the European Environment Agency[11].

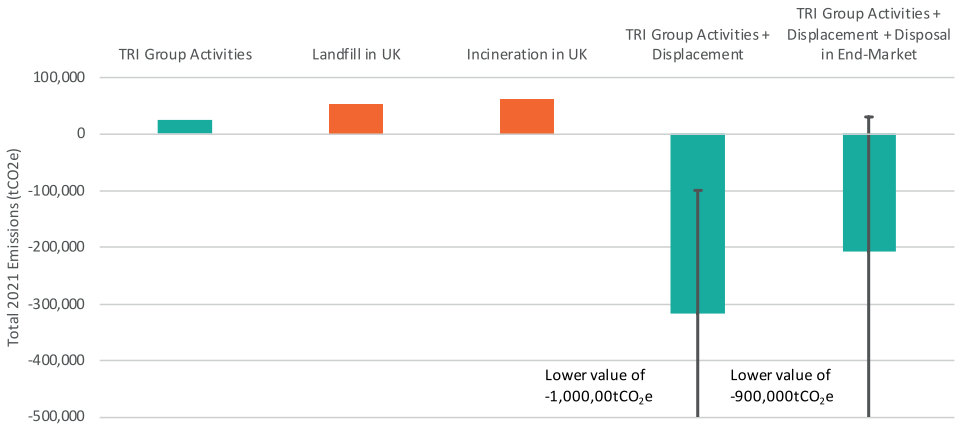
Results

The results of our comparative assessment show that the central case analysis of our processes has a net climate benefit when compared to incineration or landfill in the UK, as is shown in the graph below.

Green bars refer to:

- *TRI Group Activities: TRI Group's 2021 'core' GHG emissions (excluding EOL Treatment of Sold Products)*
- *… + Displacement: TRI Group Activities + Avoided GHG emissions due to TRI Group diverting clothing from landfill/incineration and preventing the production of new textiles through reuse and recycling*
- *…+ Disposal in End-Market = TRI Group Activities + Displacement + EOL Treatment of Sold Product GHG emissions resulting from the disposal (a combination of landfill and incineration (mainly landfill)) of textiles*

Orange bars refer to: if the textiles we sent to either landfill or incineration in the UK.



End-of-Life Treatment of Sold Products

It is worth noting the relatively large negative impact of disposal of clothing in end-markets compared to either landfilling or incineration of clothing in the UK (that's the difference between the two end green bars compared to the size of either orange bar). This is due to the assumptions that clothing in end-markets is mainly landfilled, and that those landfills in (the vast majority of) end-markets do not have gas capture technology. This impact however would be the same for new and used clothing at its EOL.

The analysis conducted by Eunomia suggests that the GHG emissions associated with incinerating the textiles that TRI Group receives would be slightly higher than the impact of landfilling the same material. This is influenced by there being a relatively significant proportion of synthetic material within the feedstock collected by TRI Group, which, in turn, is not expected to degrade in landfill appreciably over the next 100 years. This reduces the overall GHG impact associated with landfilling the feedstock received by TRI Group. The same synthetic textiles, however, will result in climate change emissions when sent to incineration. Where the climate change impact of incineration is concerned, the analysis includes a carbon credit associated with the reduced need for there to be electricity generation on the UK grid. This offsets some of the impact associated with the emissions arising from combusting materials such as textiles from synthetic fibres. However, the size of this credit has been reducing in recent years, as a result of the increasing proportion of renewable energy sources contributing to the UK's electricity grid. Incineration emissions have therefore been increasing across all types of materials as a result of this change. It should be noted that all TRI sorting facilities are Zero Waste to Landfill Accredited through Valpak.

Treatment of Uncertainty

As was discussed above, there is significant uncertainty associated with the displacement effect, and this is reflected in the error bars on the graph which reflect the range of plausible values. The results suggest that – in the worst-case scenario - impacts associated with the process operated by TRI Group (including displacement and EOL impacts) would appear to be roughly equivalent to sending clothes to either landfill or incineration in the UK. However, where the analysis uses the central-case of assumptions (which are based on relatively conservative interpretations of the latest research on this topic), there is a significant climate benefit to TRI's activities overall.

	GHG Emissions (tCO_2e)		
	Best-Case	Central-Case	Worst-Case
TRI Process		26,000	
Landfill in UK		53,100	
Incineration in UK		62,000	
TRI process + Displacement	*-1,0007,900*	-316,500	*-99,100*
TRI process + Displacement + Disposal in End-Market	*-857,600*	-166,100	*-51,200*

Limitations

We acknowledge that this study is focussed only on greenhouse gases and there are many other sustainability impacts that are relevant to the topic of reusing textiles internationally. On one side this includes the avoided water consumption and increased resource efficiency from displacing the production of new textiles, whereas on the other side this includes the air and water pollution implications of weaker waste management practices in less developed countries.

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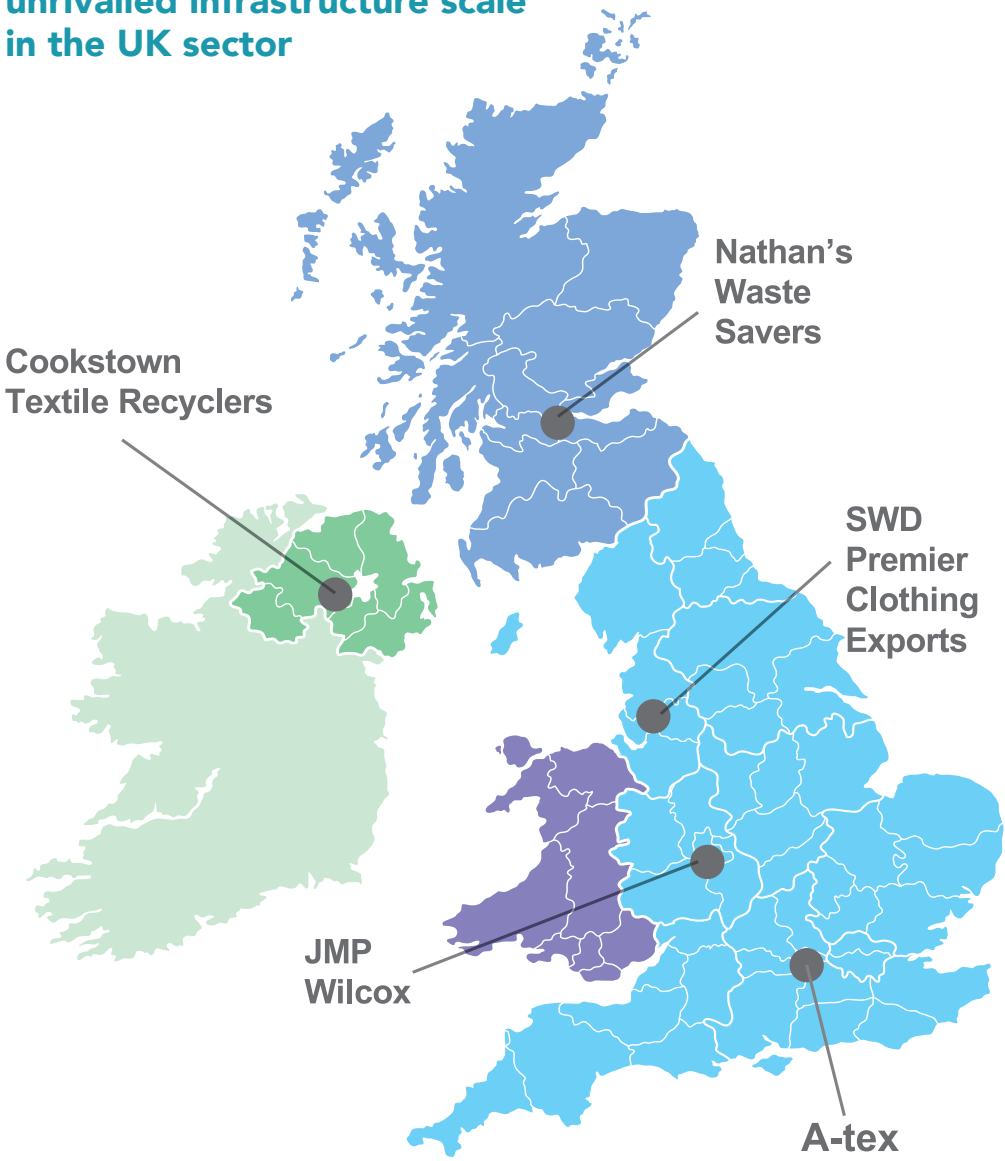
Five strategically located sites across the UK representing unrivalled infrastructure scale in the UK sector



References

1 GHG Protocol (2011) Product Life Cycle Accounting and Reporting Standard. Available at: https://ghgprotocol.org/sites/default/files/standards/Product-Life-Cycle-Accounting-Reporting-Standard_041613.pdf

2 SBTi and WRI (2018) Apparel and Footwear Sector: Science-Based Targets Guidance. Available at: https://sciencebasedtargets.org/resources/files/SBT_App_Guide_final_0718.pdf

3 USEPA (2022) Greenhouse Gas Equivalencies Calculator, Available at: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

4 Palmer, Griff (2021) Sustainable Clothing Action Plan 202 Commitment: Progress 2012-2020. Available at: https://wrap.org.uk/sites/default/files/2021-10/SCAP%20technical%20report.pdf

5 Farrant, Laura (2008) Environmental Benefits from reusing clothes. Available at: http://www.uffnorge.org/files/Laura%20Farrantenvironmental%20benefits%20from%20reusing%20clothes.pdf (Suggests a value of up to 88% in Africa)

6 Farfetched (2020) Understanding the Environmental Savings of Buying Pre-Owned Fashion. Available at: https://cdn-static.farfetchcontents.com/content/UP/PRODUCTION/LANDING-PAGES/SUSTAINABILITYCALC/Understanding%20the%20Environmental%20Savings%20of%20Pre-owned_Farfetch%20Report%202020.pdf

7 Lorenz, Jo (2020) Decolonising Fashion: How an Influx of 'Dead White Man's Clothes' is Affecting Ghana. Available at: https://ecoage.com/resources/decolonising-fashion-dead-white-mans-clothes-ghana/

8 This data was shared by member of the SCAP with TRI via email

9 Semba, Toshiro et al. (2020) Greenhouse Gas Emission Reductions by Reusing and Recycling Used Clothing in Japan. Available at: https://www.mdpi.com/2071-1050/12/19/8214

10 EcoInvent 3.7.1 factor related to glass fibre production for insulation [license required to access]

11 European Environment Agency (2019) Briefing: Textiles in Europe's circular economy. Available at: https://www.eea.europa.eu/publications/textilesin-europes-circular-economy

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