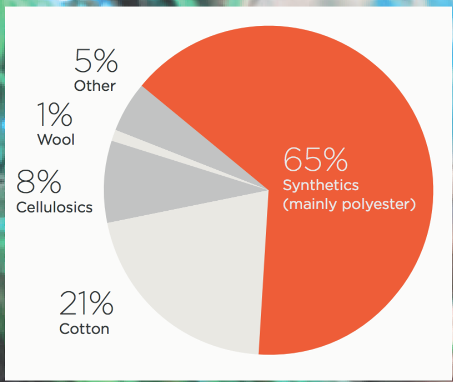
Climate Change and the Fashion Industry - Reduction of CO2 Emissions through Textile Recycling

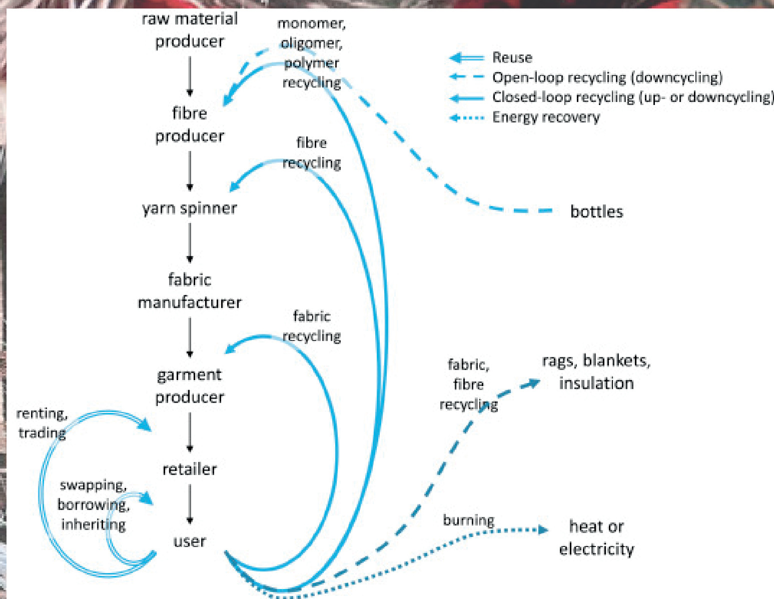
The biggest contributor to climate change is the emissions of CO2 in the atmosphere. The textile industry is responsible for producing 1.3 billion tons of CO2 equivalent (CO2e) per year, which makes up 10% of the total emissions worldwide, and it is the second largest polluter after the oil industry. A huge proportion of textile fibres as well as clothing manufacturing takes place in China and India, countries which rely on coal-fueled power plants, increasing the carbon footprint of production. A large quantity of the emissions occur during the production or cultivation of the raw fibre, and synthetic fibres based on petroleum are far more energy consuming in the production stage than natural fibres. A lot of these emissions could be reduced by efficiently reusing or recycling textile materials rather than producing new fibres.



Textile recycling has gained a lot of ground in recent years, and is considered to be a potential method for the fashion industry to reduce its carbon emissions as well as resolving issues relating to waste management. However, there are many different aspects that need to be taken into account in order to determine the real benefits of different forms of recycling. Challenges related to textile recycling include energy use, inefficient sorting methods, emissions occuring during the recycling process and the need for blending recycled fibres with virgin fibres to achieve high quality materials.

There are different methods for managing textile waste and it is important to differentiate between them in terms of use and efficiency. The most energy saving method is to put products back in use through second hand sales, clothes swapping, mending and altering and similiar enterprises; but for this the products need to be in good enough condition to be reused. When this is not possible the second most energy efficient method is material recycling, or when the textile material itself is cut into pieces which can be used to make new products. However, due to inconsistencies in material quality and the manual labour required for the process this method is difficult to scale and is mainly applicable in smaller niche markets. Most commonly these materials are downcycled and repurposed into use areas of less value, such as cleaning rags, car insulation and building materials. The third, and most complex method is fibre recycling, where textile fibres are broken down and made into new textiles. This is done in three different ways depending on the type and quality of the fibre, namely mechanical, chemical or thermal recycling.

Mechanical recycling is when the fabric is shredded and respun into new yarn and is a method often used for cellulose fibres such as cotton. The process shortens and weakens the fibres which means that they have to be blended with virgin fibres to create a useable yarn.



Chemical recycling is a method where chemical processes are applied to break down the fibres on a chemical level where they are reengineered into new fibres which can then be spun into yarn which can be used on its own or blended with virgin materials. This is possible for both synthetic and some cellulose fibres, but it requires efficient ways of sorting and separating the materials and it uses more energy than mechanical recycling as well as potentially harmful chemicals .

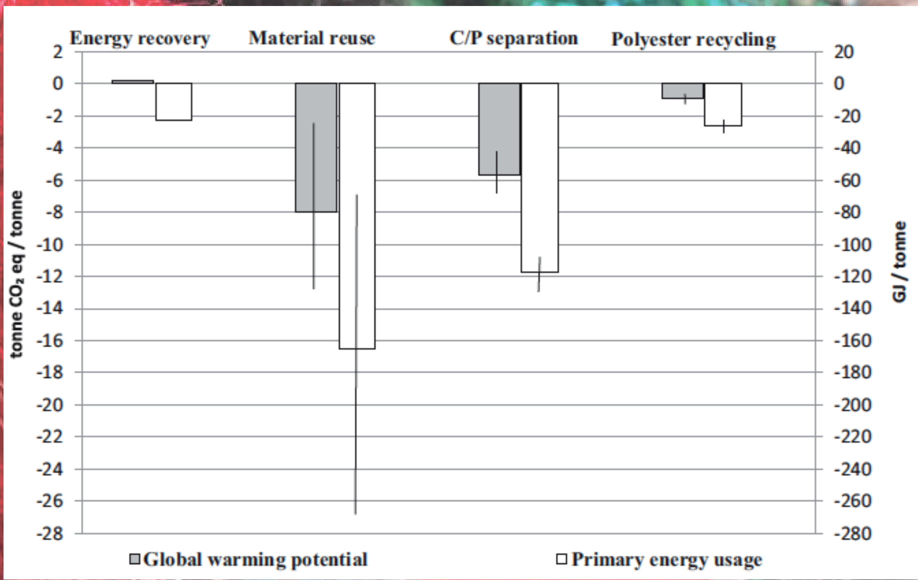
Thermal recycling is a process where heat is applied to melt down the material into a liquid form that is then extracted into new filaments. This method is used for synthetic materials, and also for creating textile materials out of none textile PET based products, like PET bottles and other plastic packaging.

In order to estimate the environmental benefits of textile recycling it is necessary to compare the Global Warming Potential (GWP) of different recycling methods to each other as well as to the production of virgin materials, and to the method of textile waste management that is most commonly practiced, namely incineration. The most conclusive studies have been made on the following processes:

Polyester recycling, where pure polyester is broken down to DMT through a chemical process and repolymerised to produce polyester granules which are melted to produce new fibres.

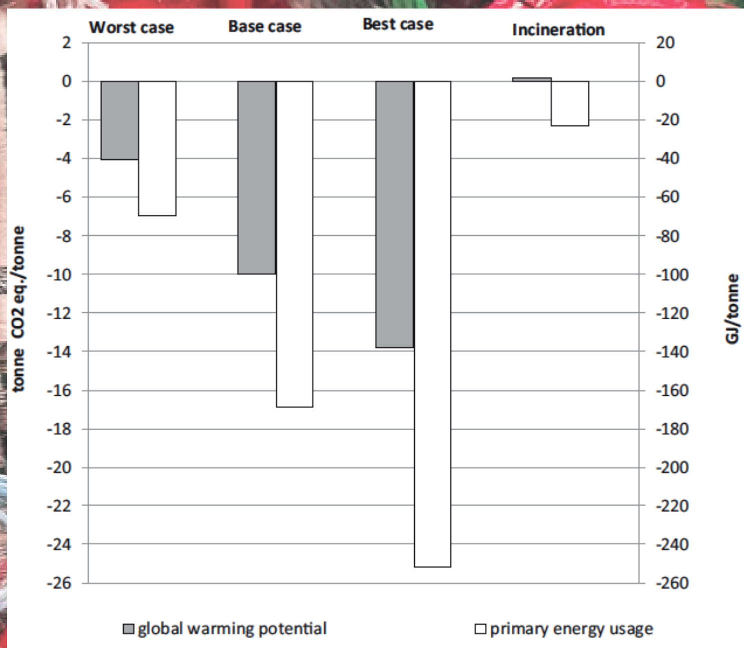
Separation of Cellulose from Polyester Using NMMO Solvent. NMMO is mixed with the shredded textile waste dissolving the cellulose while leaving synthetic fibres intact, thus separating the fibre types and turning the cellulose into a solution that can be made into new filaments.

Material recycling where the fabric is repurposed to create new products.



The graph shows how much CO2 emissions can be saved through the different recycling methods. The largest impact on the GWP is made through reduced need for virgin materials. Polyester recycling is less energy efficient than C/P separation because of high emissions in the recycling process and due to the fact that residue from other fibre types cannot be recovered and is sent to incineration

Becuase it is difficult to accurately calculate the yield of the different recycling methods it is necessary to examplify different potential turnouts. In this graph a best, base and worst case scenario have been estimated from a combination of the three presented recycling methods. Compared to the incineration alternative it can be clearly seen that even the worst case scenario has the potential to create large reductions in CO2 emissions



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