

CO2 Savings by Switching from plastic clothes hangers to NORMN cardboard hangers – THE HARD FACTS.



Everyone alive today is fully aware of the current climate crisis our planet is in called global warming. In short, it is caused by gasses in the atmosphere trapping heat from the sun, heating up the planet. One of those gasses – and by far the biggest contributor – is CO₂ (carbon-dioxide). This paper focuses on the effect our decisions and products we use can have on this particular gas and the solid form thereof – C (carbon).

We should – as a matter of urgency – replace the use of plastic with other renewable materials such as wood, cardboard etc.; Here's why in a nutshell:

Plastics are made from fossil fuels, being that oil, coal or natural gas that has been laying deep underground for millions of years. Although a very small percentage of plastics are recycled the vast majority ends up in landfill sites, the ocean or is incinerated. *So, fossil C is released as atmospheric CO₂.*

Cardboard is made from cellulose fibers, from trees that grow and photosynthesize – a process in the leaves of trees that uses chlorophyll to combine water and minerals from the soil with energy from the sun and CO₂ from the air to create organic C in the form of wood, leaves and roots. *So atmospheric CO₂ is converted to organic C.*

By using paper instead of plastic, we not only prevent more CO₂ to be released into the atmosphere but also help to reduce the current atmospheric CO₂.

Some comparison articles you might see on the internet, try to make out that paper isn't much more sustainable than plastic, this could not be further from the truth. They tend to compare the two materials only during the period when the product is made and used, but conveniently doesn't take into consideration what happens before and after that, in other words: the whole life cycle assessment (LCA). Many organizations do LCA for different materials and also comparisons between different materials – one such comparison could be read here in detail:

[Plastic vs Cardboard Packaging: A Complex Choice – EcoBahn eCom \(theecobahn.com\)](http://theecobahn.com)

According to EcoBahn, plastic have a CO₂ footprint as high as 6kg for every 1kg of plastic created.

In their report titled "Greenhouse gas emissions and natural capital implications of plastics (including biobased plastics), May 2011" the European Environment agency found that, when a 1kg plastic product comes onto the market, it has already caused at least on average 2.9 kg CO₂-eq emissions. Moreover, the same product will cause a further 2.7 kg CO₂-eq emissions when it is discarded and incinerated.

For the purposes of this report our calculations are based on the average at 5800kg CO₂ per 1 tonne new Plastic produced.

The cardboard federation of France estimates that 1 ton of cardboard produces 538kg of CO₂ during its lifecycle, which takes into account sourcing materials, transport, manufacturing, and disposal. <https://www.cartononduledefrance.org/en/eco-responsability/>

However, in a partnership with Pro Carton, the European Association of Carton and Cartonboard Manufacturers, the Research Institute of Sweden have carried out an extensive research project that's found that for every ton of cartons manufactured by the carton packaging industry in Europe, a total of 326kg of CO₂ is emitted. <https://www.twosides.info/UK/the-carbon-footprint-of-packaging/>

For the purposes of this report our calculations are based on the average at 400kg CO₂ per 1 ton new Cardboard produced.

The CO₂ footprint of newly made plastic is between 12 and 18 times higher than cardboard.

We also must consider the recyclability of the material. Plastic hangers is very difficult to recycle through the standard plastic recycling system, mainly due to the shape and colour of the item preventing proper sorting by gravitational belts and optical sensors.

Plastic recycling – all plastic items – in general is very ineffective and between 80 and 85% of plastics that does make it to the recycling Centre, still gets incinerated releasing CO₂ back into the atmosphere. Please refer to details here: <https://www.youtube.com/watch?v=RDFBbxMDi1U> This is from Germany, the best recycling nation in Europe. It is also confirmed by (UK) Westminster council.

In comparison, NORMN hangers are fully recyclable in any of the existing standard paper recycling systems already in place – ensuring a high percentage of the raw material makes it back to the processing plant to be reused. The effect of this is that the carbon originally captured by the tree stays in solid form and out of the atmosphere.

According to *Norden, the recycling of plastics emits 1.3kg of CO₂ per kg of plastic which is much better than making new plastic, but still high when compared to emission from recycling

paper. On top of that, only 9% of plastic products in Europe is made from recycled plastic which means roughly 90% of plastics ends up in landfill or is incinerated.

<https://norden.diva-portal.org/smash/get/diva2:839864/FULLTEXT03.pdf>

Product Composition. Most run-of-the-mill plastic hangers consist of primarily virgin plastic, with specialist ranges claiming to be made from recycled plastics.

NORMN cardboard hangers are not only recyclable but are made up of mostly recycled cardboard, produced under the certification of the **Forest Stewardship Council.

How to compare NORMN Cardboard Hangers to Standard Plastic Hangers?

The atmospheric CO2 impact during the total life cycle of each product needs to be considered, and will be done in 3 stages:

1. First production including Sourcing of the material, Manufacturing and Disposal/Decomposition of the product. This stage refers to CO2 costs via energy used to gather, make, and transport materials.
2. The product itself. This stage refers to C captured within the product over time.
3. Product Legacy in terms of atmospheric CO2.

Stage 1. A simple Calculation can be done to see the CO2 emitted per hanger for each material as below:

		New Cardboard	Recycled Cardboard	New Plastic	Recycled Plastic	CO2 per hanger (g)
CO2 emission during production	CO2 - g/Kg	400	300	6000	2100	
Weight of material in hanger	NORMN Premium	10.37	43.2			17.1
	NORMN Standard	10.37	31.4			13.6
	Typical Plastic			23		138.0
	Recycled Plastic				23	48.3

If we compare the standard NORMN hanger to a typical plastic hanger it emits more than 10 times less CO2 into the atmosphere. Remember that this is the CO2 released due to sourcing, transport, processing, and disposal of materials.

For every 1 million hangers, NORMN hangers **saves 124.4 tonnes of CO2** being emitted from direct production.

Stage 2. The hanger itself also contain C. Of course, different types of cardboard are made up of different compositions, but around 95–98% of cardboard is derived from wood fibers. The rest could include minerals like talc etc. to acts as binders and smoothers etc. We know that C constitute roughly 50% of wood fiber. A cardboard hanger with 32g of Cardboard therefore contains approximately $32\text{g} \times 97.5\% \times 50\% = 15.2\text{g}$ of C. This is the equivalent of 55.8g CO₂.

Plastic hangers are often made up of different types of plastic combined but generally the most common is PET (Polyethylene terephthalate) with the chemical composition of (C₁₀H₈O₄). The carbon content is about 45%. So, a hanger containing 23g of plastic holds the equivalent of 38g of CO₂.

During the existence of the hangers the CO₂ equivalent C that is captured within the product doesn't effect atmospheric

For every 1 million hangers, NORMN hangers captures **55.8 tonnes of CO₂** that was previously in the atmosphere. Plastic hangers simply move the C from underground to the surface during this stage.

Stage 3. The wider legacy of the materials often gets ignored in sustainability comparisons but could be considered the most important factor involved.

Oil extraction, hydro-fracking for natural gas and open groove mining of coal is some of the worst destructive material sourcing operations and leaves vast areas devoid of natural habitat and disrupt the eco-system. The exposure of the topsoil leads to the oxidation of soil carbon adding immeasurable amounts of CO₂ into the atmosphere.

In contrast – managed timber plantations have the exact opposite effect. A tree produces biomass both above and below ground. During the lifetime of the tree its leaves drop, and thinner twigs and branches gets cut to prevent the formation of knots in the thicker useable trunk. When the timber is harvested the below ground portion (roots) and stump remains. Together with the organic debris over the lifetime of the tree as much as 30% organic matter can be left in the soil than is removed. A lot of that becomes soil organic matter. Some of the carbon that was captured is released back into the atmosphere when the roots of the tree decomposes but a substantial percentage stay in the soil – known collectively as soil carbon. The carbon persists in the soil in the form of microbes, fungi, and a whole host of critters. Their metabolic exudates are very stable organo-mineral compounds known as humus that can lock C into the soil for very long periods if left undisturbed. This process forms the keystone of natural nutrient recycling and is also described as C-flux. The flux depends on the rate at which C is added in relation to the rate at which it is released. In a FSC managed timber production forest C is added at a quicker rate than it is released with the effect that over time the SOM builds up in the soil and sequesters

more and more CO₂. <https://www.nature.com/scitable/knowledge/library/soil-carbon-storage-84223790/> and <https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.14594>

How do we quantify such a complex process? By using averages:

- 600 trees per hectare, cut every 20 years
- 60 years for C to break down and be released 100%
- Below ground biomass = 20% of that above. Dead debris over 20 years = 10%
- 1000 kg of timber per tree harvested & 300 kg organic matter added to soil per cycle.

600,000 kg of timber after 20 years = 630,000 kg cardboard = 19,687,500 hangers.

180,000 kg of deadwood x 50% = 90,000 kg C x 3.67 = 330,300 kg CO₂ / 60 years x 20 years

So, each hanger contributes about 5.6g of CO₂ sequestered as soil carbon.

For every 1 million hangers, NORMN hangers sequesters **56 tonnes of CO₂** equivalent carbon into the soil.

When all these are taken into consideration, the compounded effect of using 1 million NORMN hangers is a saving of 236.2 tonnes of CO₂ being released into the atmosphere.

* Norden is an affiliate of the Nordic Ecolabel or Nordic swan, which is the official sustainability ecolabel for products from the Nordic countries. It was introduced by the Nordic Council of Ministers in 1989, thus completely impartial and very accurate. This report looks at the difference between Virgin Materials and recycling of the same materials, but also compare materials against each other. <https://www.norden.org/en>

** The Forest Stewardship Council is a certification system that promotes environmentally appropriate, socially beneficial, and economically viable management of the world's forests. <https://fsc.org/en>

*** The atomic weight of carbon is 12 atomic mass units, while the weight of carbon dioxide is 44, because it includes two oxygen atoms that each weigh 16. So, to switch from one to the other, use the formula: One ton of carbon equals $44/12 = 11/3 = 3.67$ tons of carbon dioxide. <https://archive.thinkprogress.org/the-biggest-source-of-mistakes-c-vs-co2-c0b077313b/>