



interseroh



Recycling for climate protection

Results of the study by the Fraunhofer Institute for Environmental, Safety and Energy Technology (UMSICHT) and INTERSEROH on CO₂ reduction by using recycled raw materials



Foreword



Dr. Axel Schweitzer

Dear Reader,

The protection of the increasingly scarce resources is, in itself, a clear argument in favour of waste recycling and the use of recycled raw materials in manufacturing. However, taking effective action means examining all aspects of an activity. In view of global warming, the reduction of CO₂ is of crucial significance for the future of our planet.

For this reason, INTERSEROH has decided to critically examine the use of recycled raw materials in comparison to primary raw materials with regard to their respective CO₂ performance. Seven relevant material flows were analysed:

- Steel
- Aluminium
- Copper
- Paper
- Polyethylene (PE)
- Polyethylene terephthalate (PET)
- Wood

We were able to mandate the renowned Fraunhofer Institute for Environmental, Safety and Energy Technology (UMSICHT) in Oberhausen to carry out the study.

The study took the entire process chain into account, from the recovery or collection of the raw materials to the logistics and the production or treatment and recycling. The company's own data were considered as part of the process chains. We attached great importance to conservative calculations and the incorporation of all CO₂-relevant aspects.

We are pleased to present to you the extremely gratifying results of this study and hope that they provide stimulating reading for you.

Yours sincerely,

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An overview of the results of the study

Relevance

Carbon dioxide (CO₂) is one of the so-called greenhouse gases. When rays of sun hit the earth, a part of the radiation is reflected by the earth's surface. Due to the so-called greenhouse gases, part of the resulting heat radiation can no longer escape into the atmosphere and contributes to global warming. The greenhouse effect and global warming are a natural process, which has, however, been increased by humans since the beginning of industrialisation.

The Intergovernmental Panel on Climate Change (IPCC) of the United Nations fears more frequent heavy precipitation, the melting of glaciers, a decrease of snow-covered surfaces, the accelerated deterioration of the Arctic Circle and a resulting increase in sea levels as consequences of increased global warming.

In Germany, CO₂ accounts for a share of over 80 % of the greenhouse gas emissions, which corresponds with approx. 830 to 870 million tons of carbon dioxide per year. The Kyoto Protocol of the United Nations calls for a reduction of greenhouse gases. As part of the EU burden-sharing scheme, Germany has committed to reduce greenhouse gas emissions by 21% by the year 2012 as compared to the level of 1990.

Recycling reduces CO₂-emissions

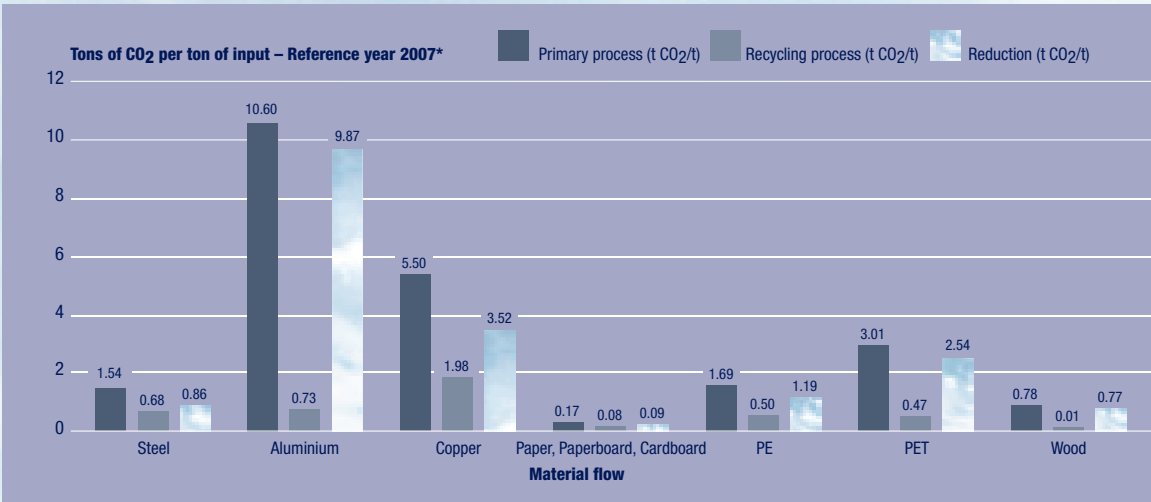
The study by Fraunhofer and Interseroh compares the CO₂ performance of the respective primary and secondary production of the material flows of steel, aluminium, copper, paper, polyethylene (PE), polyethylene terephthalate (PET) and wood with one another. The entire process chain was thereby taken into account and Interseroh's own data for the year 2007 were incorporated. For all materials, the study established a reduction of carbon dioxide emissions in the recycling process as compared to the primary process.

Interseroh raw materials save 5.2 million tons of CO₂

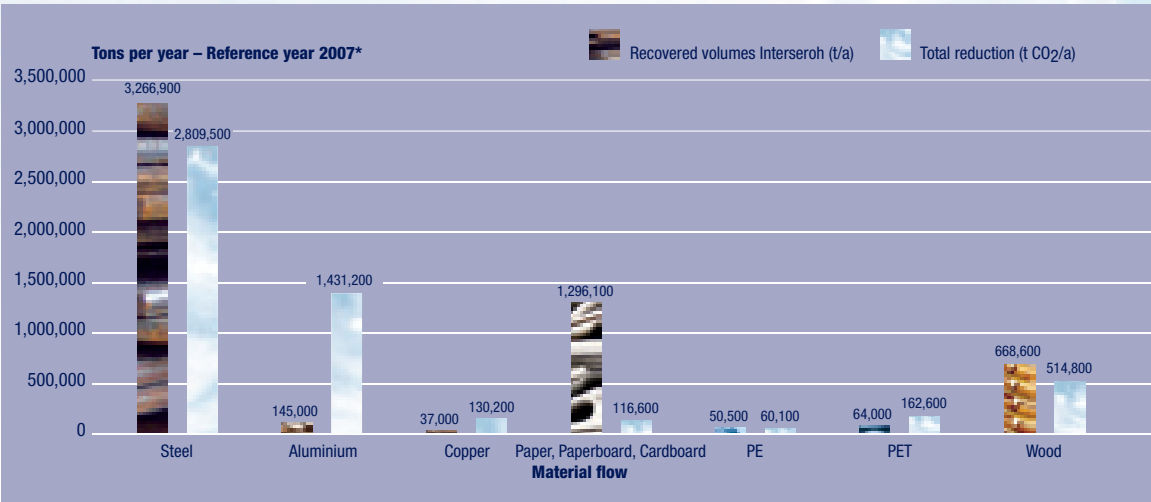
In 2007 the Interseroh Group provided industries with a total of 5.8 million tons of secondary resources. The different segments of the company are involved in the collection as well as the operative processing and the trade of the materials. The study focussed on essential material flows for the company, which cover altogether approx. 96% of the secondary resources traded by Interseroh.

Relating the CO₂ reductions of the individual material flows per ton to the respective Interseroh quantities, a reduction of over 5 million tons of CO₂ emissions is the result of Interseroh's activities in 2007. For comparison: A city with 500,000 inhabitants produces the same amount of carbon dioxide emissions yearly. Approx. 5,000 km² of mixed forest would be necessary to absorb these emissions.

Recycling reduces CO₂-emissions



Interseroh raw materials curb 5.2 million tons of CO₂



*rounded volumes



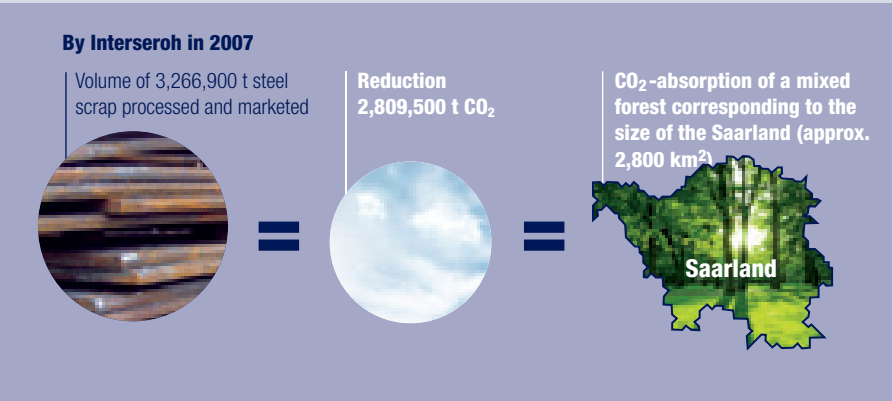
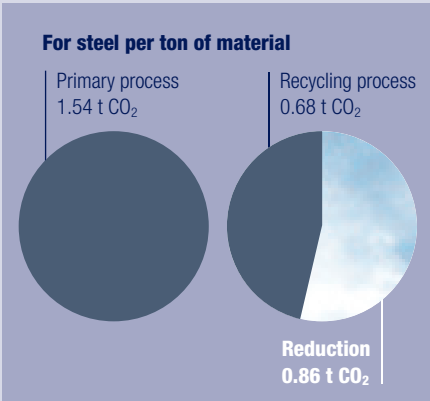
Strong steel

**In terms of sustainability, steel offers excellent preconditions:
After all, steel can be infinitely recycled without a loss in quality.**

Having produced 48.6 million tons in 2007, Germany comes first place in Europe and sixth place world-wide in the production of crude steel. In Germany approximately 30 % and in Europe around 40 % of the entire crude steel is produced exclusively from steel scrap in an electric arc furnace by way of the so-called electro-steel procedure. Yet scrap metal is also used in the primary production of steel from iron ore in blast furnaces (so-called oxygen steel procedure). Depending on the availability of the sought-after secondary raw material, it accounts for up to 20 % of the input material.

With regard to carbon dioxide emissions from the recovery of iron ore to the production in the blast furnace, approx. 1.54 tons of CO₂ are produced per ton. During the collection, treatment and processing of steel scrap, this figure is reduced to approx. 0.68 tons of CO₂ per ton of crude steel, which corresponds with a reduction of 0.86 tons of CO₂, thus around 56 %.

Reduction of CO₂-emissions



Approximately 2.8 million tons of CO₂ emissions were reduced in 2007 due to the activities of Interseroh. This coincides with the yearly CO₂ emissions of a city with around 267,000 inhabitants. A European mixed forest spanning a surface of around 2,800 km² – approximately the size of the Saarland – would be required to absorb these emissions.



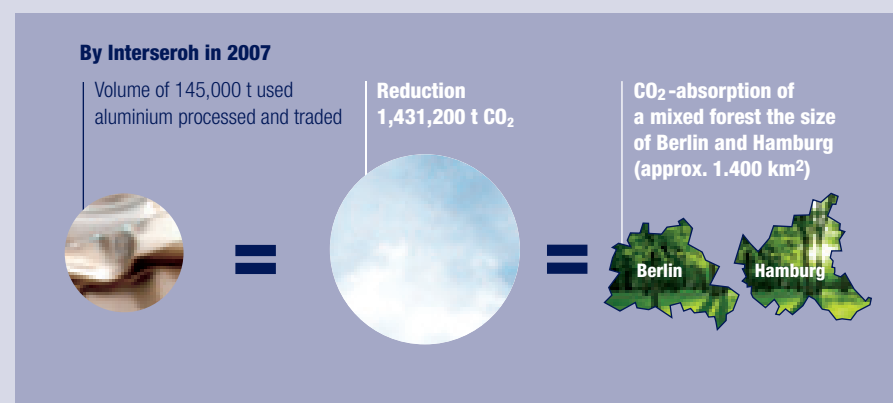
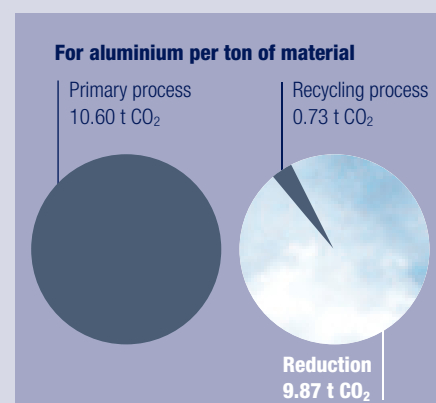
All-star aluminium

Measured by absolute CO₂-reductions, aluminium scrap is the top performer among the analysed secondary resources.

After steel, aluminium is the most frequently used metal in the world. In 2006 approx. 34 million tons of aluminium were produced world-wide, around 23 % of that as secondary aluminium. In Germany the production of recycling aluminium, which amounts to 795,000 tons, even surpasses the primary production of 515,500 tons. Furthermore, so-called aluminium metal casting, e.g. in the production of car wheel rims, also plays a role – with a share of approx. 80 % secondary alloying.

Aluminium scrap can be remanufactured almost loss-free with approx. 5 % of the manufacturing energy of the primary process and nearly without a decrease in quality. As a result, approx. 9.87 tons of CO₂ are saved per ton of aluminium in the recycling process – and thus over 93 %. Depending on the smelting plant, this reduction may be even higher in individual cases.

Reduction of CO₂-emissions



With a reduction of over 1.4 million tons of carbon dioxide Interseroh made a substantial contribution to climate protection in 2007 by recycling aluminium. This figure corresponds with the CO₂ output of a city with 135,000 inhabitants or the CO₂-absorption of a European mixed forest of 1,400 km² – i.e. the cumulative surface area of Berlin and Hamburg together.



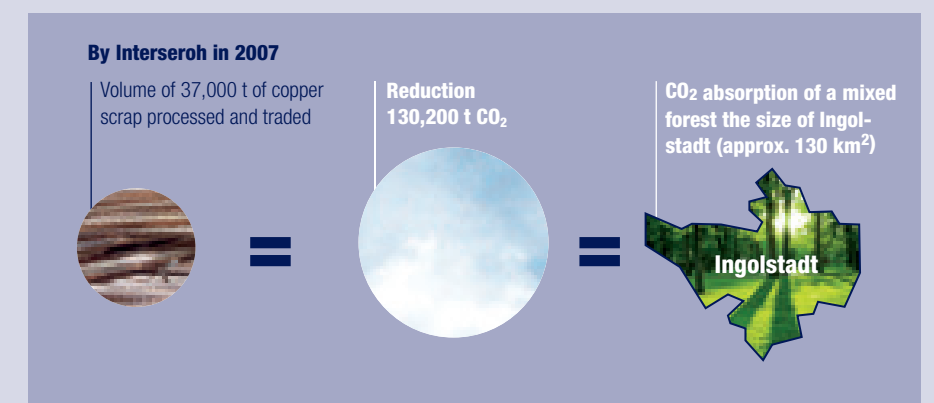
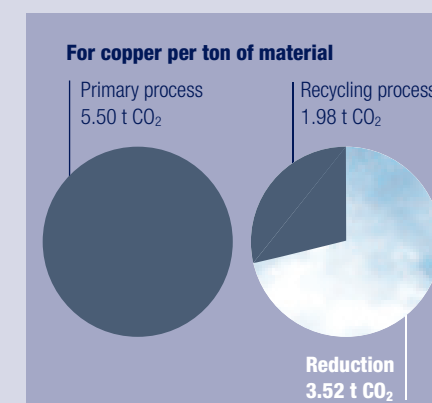
Cooperative copper

Due to its diversity, copper has always been very popular and therefore also a very valuable scrap metal.

Copper is easily mouldable, corrosion-resistant, forgeable, and an excellent conductor of heat and electricity. An additional positive feature of copper was already proven by the Colossus of Rhodes: that copper is perfect for re-melting. Nowadays, 35 % of the 17 million tons of copper processed world-wide each year already result from the recycling of copper scrap. In Europe this rate amounts to 41 % and in Germany even 45 %. If we consider that economic growth currently requires more copper than can simultaneously flow back and that copper is primarily used in very durable products, we can even speak of a de facto recycling rate of approx. 80 %.

The CO₂ comparison also turns out positively in the case of copper recycling: the secondary process saves approx. 3.52 tons of CO₂ per generated ton of copper and thus 36 % more than the primary production process from copper ore. When copper scrap is melted down, a maximum of 5 % of the material is lost, which signifies a high degree of efficiency. At the same time, there are practically no differences in quality between primary and secondary copper.

Reduction of CO₂-emissions



The amount of emissions curbed by the recycling of the Interseroh volume of 37,000 tons of copper in 2007 can be compared with the yearly CO₂ emissions of a city with 12,000 inhabitants. A 130 km²-large European mixed forest, which corresponds approximately with the size of Ingolstadt, would be required in order to absorb this volume of emissions.



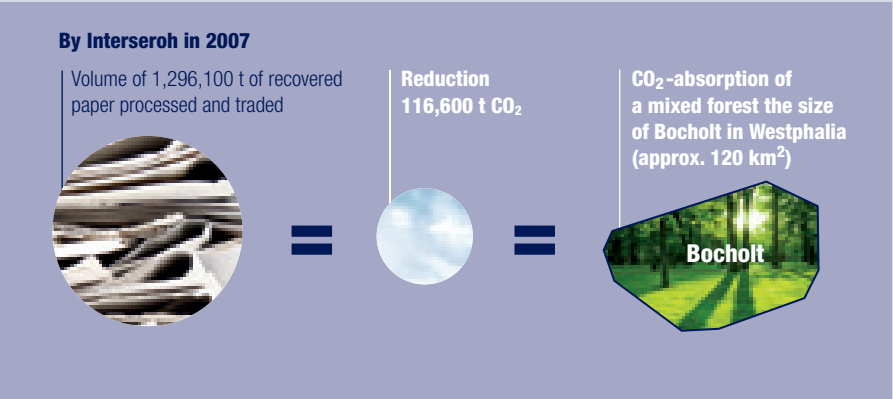
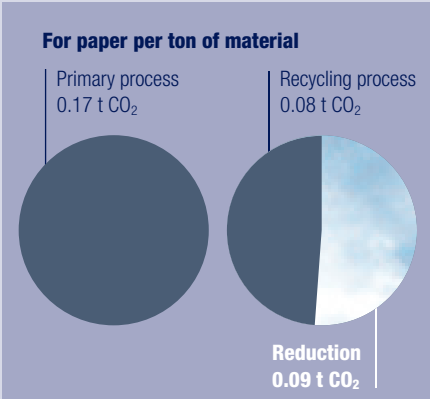
Clever paper

In terms of quantity, recovered paper is the most important raw material nowadays.

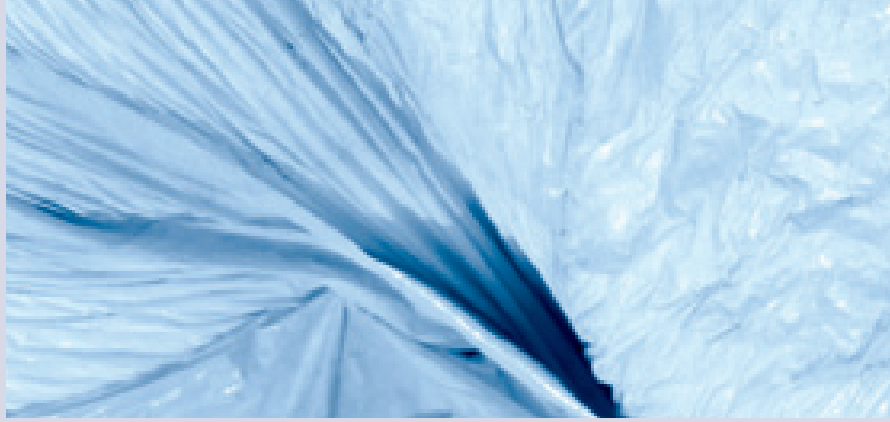
The majority of the world population uses less than 40 kg of paper per person and year. Despite the use of electronic media, this amounts to more than 200 kg in Germany. In 2007, 23.2 million tons of paper, paperboard and cardboard were manufactured, 15.8 million tons of that from recovered paper, thus around 68 %. As the largest paper manufacturer in Europe, Germany is also the forerunner in terms of the recovered paper utilisation rate. At the same time, this also demonstrates the importance of recovered paper as a raw material.

As compared to other materials, the carbon dioxide emissions are low in the manufacturing of paper. Yet both the water and the energy use are significantly lower in the manufacturing of paper fibre in the recycling process than in the primary production. However, the life-span of fibre is limited to five to seven recycling cycles. In a comparison of the CO₂ performance, the transport processes involved in the collection and delivery to paper factories are above all of consequence for the secondary process. Yet when very critically examined, the reduction still amounts to around 94 kg CO₂ per ton of paper. Moreover, the use of recovered paper protects the forests that provide a substantial contribution to the absorption of carbon dioxide, which was not yet taken into account in this study.

Reduction of CO₂-emissions



With a yearly volume of 1,296,100 tons of traded recovered paper, Interseroh contributes to a CO₂-reduction of approx. 116,600 tons of CO₂. This corresponds with the CO₂ emissions of a city with 11,000 inhabitants and the absorption by a European mixed forest of 120 km² – approximately the size of the city of Bocholt.



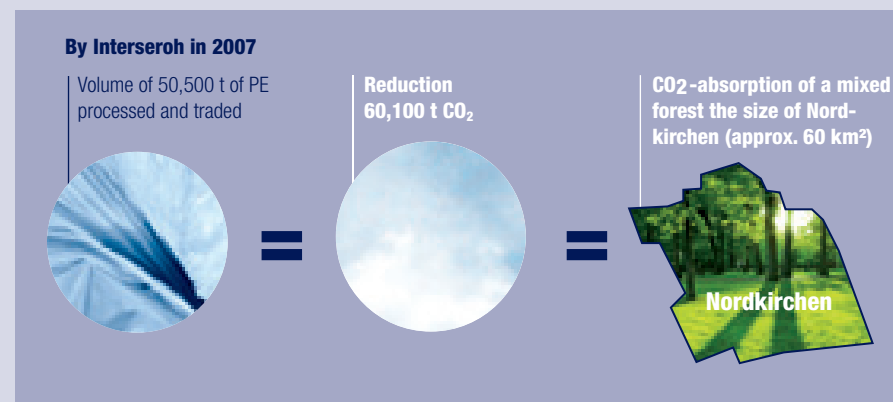
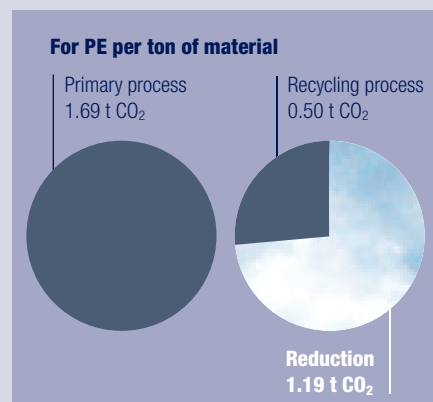
Practical Polyethylene (PE)

Sophisticated recycling techniques allow for the processing and re-utilisation of used plastics such as polyethylene.

Approx. 245 million tons of plastics were produced world-wide in 2006, nearly 30 % of them polyethylene. Germany's share in PE production totals around 2.9 million tons. PE is used as a packaging material, but is also employed in electrical, construction, machine, and vehicle engineering.

With the contemporary recycling processes, PE can be recycled four to five times. Afterwards, the decreasing length of the molecule chains no longer permits any further recycling. An exemplary analysis of PE with low density (LDPE) – which is wide-spread in the form of foil as a packaging material – shows that a reduction of 1.19 tons of CO₂ per ton of polyethylene is achieved in the secondary process. This corresponds with a reduction of around 70 %.

Reduction of CO₂-emissions



By organizing the recycling of approx. 50,500 tons of PE foil, Interseroh was able to reduce CO₂ emissions by approx. 60,100 tons, which corresponds with the consumption of a small town with approx. 5,500 inhabitants. A European mixed forest of 60 km², thus the size of the city of Nordkirchen (North-Rhine Westphalia), could absorb this volume.



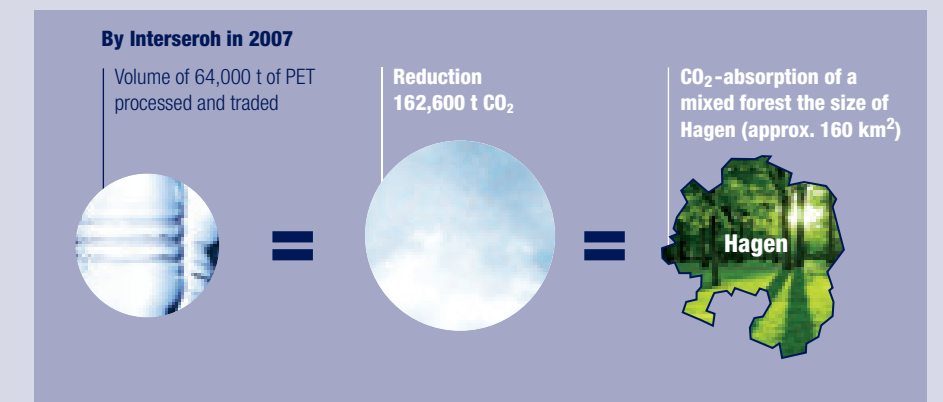
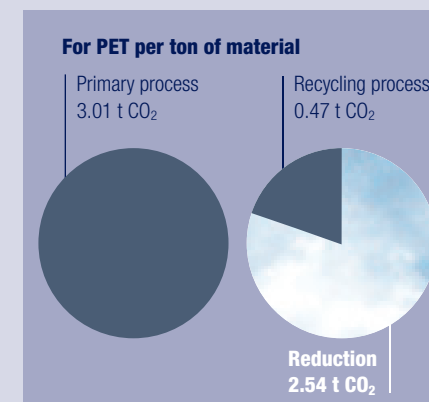
Smart Polyethylene terephthalate (PET)

Increasing crude oil prices and finite resources are making it increasingly important to recycle plastics such as PET.

An estimated 4% of the global oil consumption world-wide is used to produce plastics. The plastic polyethylene terephthalate is a popular material used in beverage bottles, textile fibres, food packaging, foils, among other things and has been a hot topic ever since the introduction of the deposit for disposable bottles in Germany. In Germany 560,000 tons of PET were produced in 2006.

Due to the organized return of PET-bottles as part of the disposable bottle deposit systems, large quantities of used and already sorted PET exist in Germany – a fact that significantly facilitates the recycling process. If the production of PET granulate in the primary and secondary process are compared, the reduction of carbon dioxide amounts to almost 85 % – even if the sometimes long transport paths to Southeast Asia are taken into account. Around two thirds of the recycling PET can be found in textiles, the rest in foils, plates, bottles, tapes, and other products. PET can thereby undergo up to eight recycling processes.

Reduction of CO₂-emissions



A city with 15,200 inhabitants produces 162,600 tons of CO₂ annually. Interseroh cuts down emissions by this volume, which is comparable to the emissions absorbed by a European mixed forest spanning approx. 160 km² – thus the size of the city of Hagen.



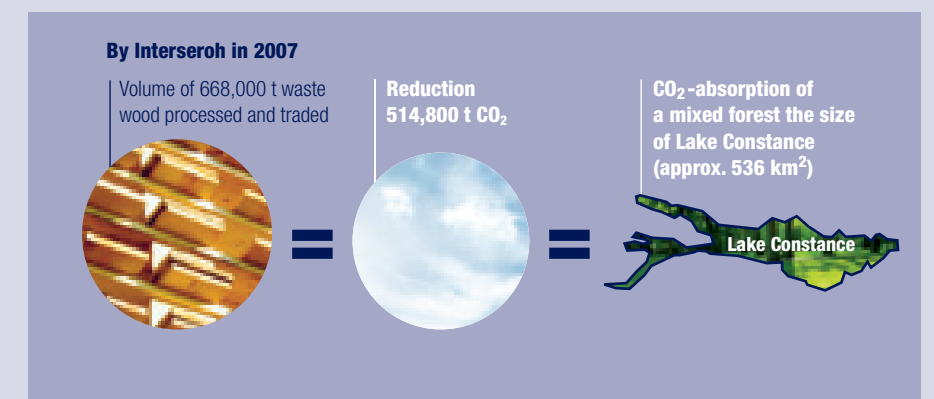
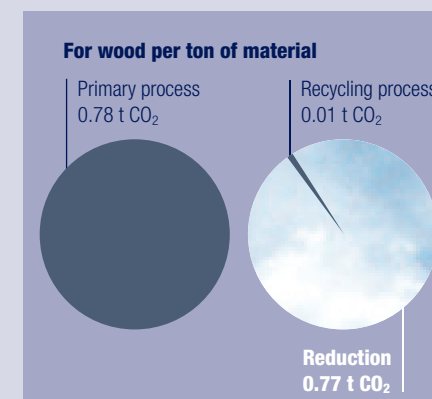
Wonderful wood

With an almost 99% CO₂ reduction compared to the primary process, waste wood recycling yields the best result of all studied material flows.

European mixed forests can absorb between four and twelve tons of CO₂ per hectare and per year and tropical dry forests even up to 55 tons. The same volume respectively is released during the combustion process, which makes the recovery of energy from wood a CO₂-neutral process. In 2006 62.3 million cubic metres of wood were chopped down in Germany and 8.2 million cubic metres of chipboard produced.

Waste wood can be recovered for energy purposes to generate electricity and heat. During the corresponding primary process, the distribution of the energy sources was analysed in the generation of electricity and heat in Germany. As regards the material recycling of waste wood, the primary and secondary production of chipboard was considered. Taking into account the relationship between these two recycling approaches at Interseroh, the study revealed that 0.01 tons of CO₂ were emitted in the secondary process, thus resulting in a reduction of approx. 0.77 tons.

Reduction of the CO₂-emissions



With its total volume of waste wood, Interseroh achieved a reduction of CO₂, which coincides with the absorption by a European mixed forest spanning 520 km² – approximately the size of Lake Constance (536 km²). The effect with regard to the preservation of the existing forest has yet to be taken into account here.

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Author



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Energietechnik UMSICHT

The Fraunhofer Institute for Environmental, Safety and Energy Technology (UMSICHT) is one of 56 institutes of the Fraunhofer-Gesellschaft in Germany. It employs over 240 staff members at its headquarters in Oberhausen and generated a turnover of 17.9 million Euros in 2007. The institute develops, tests, evaluates, and optimises technical procedures and materials and views itself as an interface between science and the economy.

The business segment Resources Management, which carried out the study, concentrates on material flow and innovation management, research on biomass potential, market, technology, and trend studies as well as the ecological and economical evaluation and optimisation of processes.

Contracting party



interseroh

Under the roof of ALBA Group, Cologne-based INTERSEROH SE operates in over 100 locations and employs over 2,200 staff members. The company stands for high quality recycling and modern closed-loop recycling management. Its tasks include the collection, transport, treatment, and recycling of empty packaging, end-of-life products and scrap metals in various European countries. Interseroh thereby guarantees industry the procurement of valuable secondary resources, traded worldwide, for production activities. In 2007 this amounted to approx. 5.8 million tons of secondary raw materials. The Group generated a turnover of 1.75 billion Euros.

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