ENVIRONMENTAL GUIDE FOR PULP & PAPER PRODUCTION

CONTENTS

Aim and contents of the document:

The “Environmental Guide for Pulp & Paper Production” is a guide for interested stakeholders of pulp and paper industry, which aims to support a better understanding of the relevant environmental aspects and environmental performance data of pulp and paper production.

It contains explanations of relevant environmental terms, parameters and topics within the pulp and paper value-chain and provides respective background information as well as a rating of the relevance of specific environmental information for the reporting and benchmarking of the environmental performance of paper products.

References

The contents of the present document are largely based on the “Environmental Guide for Pulp & Paper Production” written by sdguide.org, who offers consultancy services for environmental and sustainability management with a special focus on the pulp and paper value-chain. According to the “Fairware principle” as defined by sdguide.org the “Environmental Guide for Pulp & Paper Production” can be used for any purpose even for commercial ones for free as long as its origin is referenced. It is however expected, that commercial users make an adequate contribution (e.g. donation) to its further improvement/development.

1. EMISSIONS TO WATER

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1.1 Water consumption/effluent formation

Origin:

Compared to other industries relatively high water consumption of pulp and paper industry is a consequence of the fact, that pulp and paper making from process engineering perspective is a typical wet process. Process water is needed to cook, bleach, transport, wash the fibre during pulping and dilute, solve, arrange, treat many different materials to a uniform suspension (wet paper pulp) and distribute it finally on the wet-end of a paper machine.

Because of the high energy-intensity of the processes also considerable volumes of cooling water are used, which however normally does not get contaminated.

Environmental impact:

High water consumption itself either can have a very high impact (in water scarce regions), but also a low or neutral one (in regions, where there is plenty of water around). It must always be considered, that the water is actually not really consumed, but only used. If for example the water is taken out from a big river and after careful treatment again released back to the same river, there is not necessarily a negative impact to the environment. If the water is taken out from a potential drinking water reserve in a very water scarce area and released considerably polluted, the impact of course can be significant.

This means, that for example a "zero-effluent mill" will not necessarily be the best option for the environment everywhere, because in most cases other negative environmental impacts come along, if the water-cycle gets more and more closed.

Nevertheless in most cases higher water consumption will also mean higher energy consumption for pumping and treating and usually the water consumption is a good indicator how far Best Available Technique (BAT) has been implemented in the whole production process.

The environmental impact of cooling water usually can be neglected, except maybe for very small receivers of the warm water, where the associated temperature-increase is a limiting factor. But it must also be considered, that less cooling water will not automatically mean less heat to the receiver.

Reduction measures:

- By using the process water in a cascaded way the water cycle can be closed to a certain reasonable extent, which according to Best Available Technique (BAT) is about 8-15 m^3/ton for paper production and about 30-50 m^3/adt for virgin fibre production.
- Reduction measures for cooling water are usually not taken, but in many mills the cooling water gets reused as process water.

Relevance:

In any case process water consumption is of high relevance within pulp and paper industry.

Cooling water consumption however is of low relevance and in many countries even not measured.

Whereas in some countries it is more common to measure and report the process fresh-water consumption, in others the effluent volume is measured and of course some mills can provide measurements for both parameters. Anyway with one figure the other one can be estimated to a satisfying extent.

1.2 COD [Chemical Oxygen Demand]

Origin:

The parameter "COD" represents the Chemical Oxygen Demand, which is needed to chemically oxidize all the organic substances in the effluent. COD is therefore a sum-parameter for the organic pollutants, which are released by the mill into the water.

In terms of pulp production these are all kinds of different substances that are formed during pulp cooking and bleaching and do not get combusted within the black liquor.

In terms of paper making the majority of the COD originates from the dissolvable paper raw-materials and aids (starch, other binders, coatings, OBAs, etc.).

Environmental impact:

Organic substances, which are easily degradable and get released into the natural environment (e.g. rivers, lakes) have the potential to significantly negatively influence the water quality because the available oxygen gets consumed during their degradation.

Other organic substances can be hardly biodegradable or even be persistent and can in some instances have other specific negative effects.

It is important to understand, that from environmental perspective the acceptable absolute load of organic pollutants into the environment is very much dependent on the kind and size of the recipient (small rivers or lakes in comparison with big rivers and the sea).

Reduction measures:

- Efficient control of the pulping process/application of paper aids avoids COD emissions
- Efficient effluent treatment (Mechanical & Biological stages)
  - If Best Available Technique (BAT) is applied depending on the kind of effluent and other circumstances COD reduction efficiencies from 75% to 95% are achievable.

Relevance:

Together with the Adsorbable Organic Halogens (AOX) emissions the COD emissions represent the most important key performance indicator for effluents from pulp and paper mills.

Since efficient COD elimination usually goes hand in hand with efficient Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) elimination, the performance related to COD to a certain extent also provides information about the performance related to BOD and TSS.

1.3 BOD [Biochemical Oxygen Demand]

Origin:

The parameter "BOD" represents the Biological or Biochemical Oxygen Demand, which is consumed by micro-organisms to oxidize organic substances in the waste water in a certain time. If this oxygen consumption by micro-organisms is measured over a period of 5 days for example the parameter is called BOD_5. The BOD is a measure for the biodegradability of the organic pollutants in the waste water.

The BOD must always be lower than the COD and would become equal to the COD, if the micro-organisms would manage to fully degrade all organic substances in the defined time. A (in comparison to the COD) relatively high BOD value therefore indicates for example, that the pollutants are easily biodegradable, a relatively low BOD indicates that the pollutants are hardly biodegradable.

Environmental impact:

Organic substances that are easily bio-degradable and get released into the natural environment (e.g. rivers, lakes) have the potential to negatively influence the water quality because the available oxygen gets consumed during their degradation.

It is important to understand, that from environmental perspective the acceptable absolute load of easily biodegradable organic pollutants into the environment is very much dependent on the kind and size of the recipient (small rivers or lakes in comparison with big rivers and the sea).

Reduction measures:

- Efficient control of the pulping process/application of paper aids
- Efficient effluent treatment (Mechanical & Biological stages)
  - If Best Available Technique (BAT) is applied, depending on the kind of effluent and other circumstances BOD reduction efficiencies from 95% to almost 100% are achievable.

Relevance:

Since the COD parameter to a certain extent also provides information about the performance related to Biological or BOD and TSS, the reporting of the BOD is of comparably less importance. Consequently the performance of pulp and paper making in terms of organic water pollution can be covered by the reporting of the COD to a satisfying extent. If COD emissions however are not known/measured/reported the BOD figure is of high relevance.

1.4 AOX [Adsorbable Organic Halogens]

Origin:

The parameter "AOX" is the sum of all Adsorbable Organic Halogens in the waste water. This sum-parameter covers many different substances of similar specific chemical properties but of very different hazardousness.

In pulp and paper-industry AOX are mainly generated by usage of chlorine gas or chlorine containing chemicals for the bleaching process.

Environmental impact:

AOX emissions should be minimized because many of them show ecologically problematic properties (toxic, mutagen and carcinogen effects, hardly biodegradable, bio accumulative). Dioxines, among them some of the most toxic substances known, are for example AOX. Dioxines in the effluent however can be fully avoided by TCF and ECF bleaching plants, since they are only generated, when chlorine is used directly as a bleaching agent.

Reduction measures:

With total chlorine free (TCF) bleaching processes AOX can be totally avoided, with elemental chlorine free (ECF) bleaching processes according to BAT they can be reduced to an from environmental perspective acceptable level.

Because of the very specific and in the past undoubtedly unacceptable extent of AOX emissions from pulp and paper industry the applied bleaching processes and substances (TCF, ECF, PCF) still get certain attention on specific environmentally sensitive markets and should be described in detail:

1.4.1 Bleaching technologies

1.4.1.1 Chlorine bleaching

For "Chlorine bleaching" elemental Chlorine (Cl_2) is used as a bleaching agent.

Elemental Chlorine is pure Chlorine, which is under normal conditions gaseous (Cl_2). Bleaching with Chlorine causes unacceptable high emissions of AOX, among them Dioxines.

1.4.1.2 ECF-bleaching

"ECF" stands for an "Elemental Chlorine Free" bleaching process, which means that Elemental Chlorine is NOT used as a bleaching agent, but Chlorine-containing substances, such as mainly Chlorine-Dioxide (ClO_2). Although still some Chlorine is involved in the process, the emissions of AOX can be significantly reduced (up to a factor of 100) and the formation of Dioxines in the effluent systematically be avoided.

1.4.1.3 TCF-bleaching

"TCF" stands for a "Total Chlorine Free" bleaching process, which means that neither Elemental Chlorine nor Chlorine-containing substances are used as bleaching agents.

Instead only Oxygen based bleaching agents like pure Oxygen (O_2), Ozone (O_3), Hydrogen peroxide (H_2O_2) and Peracetic Acid ($C_2H_4O_3$) are utilised. Consequently the formation of AOX from bleaching can be systematically avoided.

1.4.1.3 PCF-bleaching

"PCF" stands for "Process Chlorine-Free", which indicates that the fibre has been recycled and after recycling either no additional bleaching was performed or the re-bleaching was performed without the use of any chlorine derivatives. Although for PCF-bleached recycled papers no chlorine compounds are used, recycling papers usually do have a certain content of organic chlorine (OX), which originates from the former bleaching of the virgin fibres.

1.4.1.5 AOX emissions related to different bleaching technologies

Since the AOX emissions represent a very specific and in the past highly sensitive environmental impact from the pulp and paper industry, they represent besides the COD one of the most important key performance parameters especially for pulp effluents.

Also during paper production some emissions of AOX can be caused (e.g. by application of Halogen containing biocides or from AOX emissions coming from the pulp used for paper production), these are usually negligible and from relatively lower relevance.

1.5 TSS [Total Suspended Solids]

Origin:

TSS stands for the Total Suspended Solids that are emitted within the effluent and consist of fibres and inorganic fillers and pigments.

Environmental impact:

Usually no specific environmental problems are caused by these emissions as long as certain concentration levels are met.

Reduction measures:

For an efficient biological treatment of the effluent it is in any case necessary to separate TSS from the waste water by different mechanical treatment stages, such as sedimentation, filtration, flotation etc.

Relevance:

Since the COD parameter to a certain extent also provides information about the performance related to BOD and TSS, the reporting of the TSS is of comparably less importance. Consequently the performance of pulp and paper making in terms of water pollution can be covered by the reporting of the COD to a satisfying extent. If COD emissions however are not known/measured/reported the TSS figure is of higher relevance.

1.6 N_{tot} [Total Nitrogen]

Origin:

N_{tot} stands for the Total Nitrogen that is emitted within the effluent. In pulp and paper industry emissions of Nitrogen mainly come from pulp (Wood as well as all organic material also contains Nitrogen, which gets dissolved mainly during the pulp cooking process). In comparison with other industries, with specific Nitrogen emissions pulp and paper production is not a main source for these emissions. Many mills even add Nitrogen during biological effluent treatment to keep the C:P:N ratio in a certain range, which is crucial for the growth of the bacteria and thus for the COD reduction efficiency.

Environmental impact:

Like Phosphor Nitrogen is a nutrient and can disturb the ecological balance of natural water streams, for example by increased growth of algae and other organisms (effect of eutrophication). The resulting impact to natural water systems is very dependent on the size of the recipient.

Reduction measures:

Although Nitrogen emissions do occur in pulp and paper effluents, in some cases Nitrogen even has to be added to the waste water in order to allow an efficient degradation by the microorganisms. Nitrogen emissions from pulp and paper mills also get reduced (consumed) during biological effluent treatment to a certain extent but are usually not actively controlled (meaning, that in most cases no specific tertiary Nitrogen elimination measures are/have to be taken).

Relevance:

Since Nitrogen emissions are not very specific for pulp and paper industry their relevance can in any case be considered as lower than of COD or AOX emissions. Nevertheless because of their general relevance they have to be measured in most cases and should be reported. In most cases the Nitrogen emissions from pulp production will be of significantly higher relevance than those from paper production.

1.7 P_{tot} [Total Phosphor]

Origin:

P_{tot} stands for the Total Phosphor, which is emitted within the effluent. In the pulp and paper industry, emissions of Phosphor mainly come from pulp production. (Wood as well as all organic material also contains Phosphor containing substances to a certain extent, which get dissolved mainly during the pulp cooking and esp. bleaching process). In comparison with other industries with specific Phosphor emissions pulp and paper production is not a main source for these emissions. Many mills even add Phosphor during biological effluent treatment to keep the C:P:N ratio in a certain range, which is crucial for the growth of the bacteria, and thus for the COD reduction efficiency.

Environmental impact:

Like Nitrogen Phosphor is a nutrient and can disturb the ecological balance of natural water streams, for example by increased growth of algae (effect of eutrophication). The resulting impact to natural water systems is very dependent on the size of the recipient.

Reduction measures:

Although Phosphor emissions do occur in pulp and paper effluents, in some cases Phosphor even has to be added to the waste water in order to allow an efficient degradation by the micro-organisms. Phosphor emissions from pulp and paper mills also get reduced (consumed) during biological effluent treatment to a certain extent but are usually not actively controlled (meaning, that in most cases no specific tertiary Phosphor elimination measures are/have to be taken).

Relevance:

Since Phosphor emissions are not very specific for pulp and paper industry their relevance can be considered as lower than of COD or AOX emissions. Nevertheless because of their general relevance they have to be measured in most cases and should be reported. In most cases the Phosphor emissions from pulp production will be of significantly higher relevance than those from paper production.

2. EMISSIONS TO AIR

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2.1 SO_2 [Sulphur Dioxide]

Origin:

SO_2 represents Sulphur Dioxide, which is a gas and is usually mainly created by burning of sulphur-containing fuels, such as heavy fuel oil and coal.

Within virgin fibre production it additionally arises, since either it is used directly as a cooking agent (Sulphite process) or it is formed during the combustion of the black liquor in the chemicals recovery process (Sulphite and Sulphate process).

Environmental impact:

In the natural environment SO_2 reacts to sulphuric and sulphurous acids and consequently causes together with the NOx the phenomenon known as "acid rain" (acidification) and in higher concentrations also bears the risk of negative health impacts to human beings (e.g. Asthma).

Reduction measures:

Within pulp and paper industry emissions of SO_2 can be avoided by usage of specific "clean" fuels (such as natural gas, low-sulphur containing oil and coal) and by the efficient recovery of chemicals (BAT). Additionally they can be minimized end-of-pipe by different means of flue-gas desulphurisation.

Relevance:

Because of the high energy intensity of pulp and paper production and also because SO_2 represents a specific process emission from pulp production, the SO_2 emissions are one of the environmental key performance parameters for pulp and paper products related to air emissions.

2.2 NO_x [Nitrogen-Oxides]

Origin:

NO_x is a sum-parameter for all kinds of Nitrogen-Oxides such as NO, NO_2. They are formed in all processes at atmospheric conditions (meaning under the presence of Nitrogen), where very high temperatures occur (e.g. all kind of combustion processes, engines, etc.). In difference to the formation of SO_2 emissions, which arise as a consequence of the Sulphur content of the fuel, the formation of NO_x is not primarily dependent on its Nitrogen content.

Within pulp and paper industry they mainly arise out of all combustion processes (black liquor, biomass, fossil fuels) for energy generation and the transports.

Environmental impact:

NO_x are major contributors to smog formation and acid deposition and at higher concentrations NO_x are associated with adverse health effects.

Reduction measures:

Emissions can be avoided and/or reduced by optimizing/maintaining combustion conditions (low temperatures) and specific catalytic and non-catalytic NO_x reduction technologies.

Relevance:

Because of the high energy-intensity of pulp and paper industry the NO_x emissions represent in any case a relevant environmental key-performance parameter related to air emissions.

2.3 Particulates [TSP, Total Solid Particulates]

Origin:

Particulates are solids from smoke, dust or other substances that can hang in the air and remain as separate particles for long periods of time. Within pulp and paper production Particulates mainly arise from energy production (esp. from combustion of solid fuels, such as coal and biomass).

Environmental impact:

In higher concentrations Particulates cause breathing problems and especially the smallest particulates are considered as problematic in that context.

Reduction measures:

There are many kinds of flue gas filters for reducing particulate emissions. Within pulp and paper industry besides other measures usually highly efficient electrical precipitators represent the Best Available Technique.

Relevance:

Nowadays within pulp and paper industry particulate emissions usually only represent a significant environmental impact in old mills, where Best Available Technique (BAT) is not applied and efficient reduction measures are not taken. Consequently, if a mill has applied BAT within its energy plant, the parameter might not be of highest relevance any more in comparison with others.

2.4 TRS [Total Reduced Sulphur]

Origin:

"TRS" stands for Total Reduced Sulphur, which within pulp and paper industry is a sum parameter for mainly the following substances:

- Hydrogen Sulphide (H_2S)
- Methyl Mercaptan (CH_3-SH)
- Dimethyl sulphide ($(CH_3)_2S$)
- Dimethyldi Sulphide $(CH_3)_2S_2$

The TRS are on the one hand very toxic in higher concentrations, but also extremely smelly and this already in very low concentrations.

The emission of TRS is the reason for the typical smell around Sulphate pulp mills, since they arise mainly out of the pulp production process, but they are also formed in waste water treatment plants and canals, where Sulphur containing waste water is present under anaerobic conditions.

Environmental impact:

Whereas TRS are highly smelly in lower concentrations, they are not perceived similarly strong in higher concentrations and consequently they represent an actual risk for human life and need certain awareness in the pulp mills. If modern TRS reduction measures are applied the remaining TRS emissions usually will not cause damage to the environment or direct health problems for the neighbour communities, however the smell in some instances still represents at least an annoyance with the potential of significantly disturb their well-being.

Reduction measures:

TRS can efficiently be avoided only by closed reactors and the systematic collection and incineration of unavoidable remaining emissions. Whereas in modern mills such equipment is a matter of course, the integration into older mills can mean high technical efforts and investments.

Relevance:

Because of their specificity for the Sulphate Pulping process the TRS in any case represents a relevant environmental key-performance parameter for that process, however, in comparison with other parameters they might not fall under the most important ones for determining the environmental footprint of paper products. From local community perspective, however, it is a highly relevant parameter for pulp production. TRS emissions from paper production mainly come from effluent treatment and are negligible, which is the reason that they are usually not measured.

2.5 CO_2-fossil [Fossil Carbon Dioxide]

Origin:

Fossil Carbon Dioxide emissions result from the combustion of fossil fuels, such as coal, oil and gas for energy production and from the burning of limestone and other minerals (esp. carbonates) e.g. for cement production and other applications.

Within the pulp and paper-making processes, CO_2 arises usually exclusively from fossil fuel based energy production. Modern pulp mills however, which efficiently utilize the black liquor and other waste biomass for energy production are fully energy self sufficient and can even provide significant amounts of surplus energy (both steam and/or electricity) to either integrated paper mills, the community or other third parties. In such mills fossil fuels are only needed for start-ups, as a back-up fuel and other unusual conditions. Consequently the emissions of CO_2-fossil, if BAT is applied within pulping, usually are attributed to paper production.

Environmental impact:

The emissions of CO_2-fossil from fossil fuel combustion are considered as one of the most significant drivers of climate change.

Reduction measures:

In comparison with all other emissions to air CO_2-fossil emissions usually are not and because of cost reasons cannot be reduced by secondary measures (filters, deposition, etc.). However they can be avoided to a certain extent and minimised;

1) Firstly by the reduction of unnecessary energy consumption (BAT within energy generation, distribution and application, besides cogeneration esp. also insulation and heat recovery)
2) By the preferred utilisation of less carbon intensive fossil fuels (e.g. natural gas in comparison with coal) or other as more or less carbon-neutral considered renewable energy sources (e.g. waste biomass, solar/wind energy).
3) Also nuclear energy in current regard as a not carbon-intensive energy source.

It should be stressed, that especially the first option really provides an efficient contribution to mitigate climate change, because energy consumption gets really avoided/reduced. The substitution of one energy source by another in most cases not necessarily means an overall improvement for the environment since globally all these energy sources substitute each other. Only if additional capacities are generated (wind/solar power plants, real "waste biomass", which was not utilised before) the overall footprint will improve.

Relevance:

Since the emissions of CO_2-fossil from fossil fuel combustion are nowadays considered as one of the most significant drivers of climate change, these emissions have gained highest awareness. Life Cycle Assessments show, that if Best Available Technique (BAT) is generally applied, for most paper products among all environmental impacts the emissions of CO_2-fossil do represent the most significant one.

However, because the CO_2-fossil figure does not really show, whether the "carbon-neutral" renewable energy is also utilised efficiently (which is at least similar important as its neutrality) the CO_2-fossil figure always should be rated and benchmarked considering/in combination with the key-energy efficiency figures of the plants.

2.6 ODS [Ozone Depleting Substances]

Origin:

ODS stands for Ozone Depleting Substances and is consequently a sum-parameter for substances that cause damage to the ozone layer in the stratosphere (formation of the "ozone-hole"). The most important ODS are Halons (halogenated carbon compounds) such as Chlorofluorocarbons. Within pulp and paper production ODS do not play a relevant role since they are not needed for production, except for coated products based on ODS containing coatings or solvents.

Environmental impact:

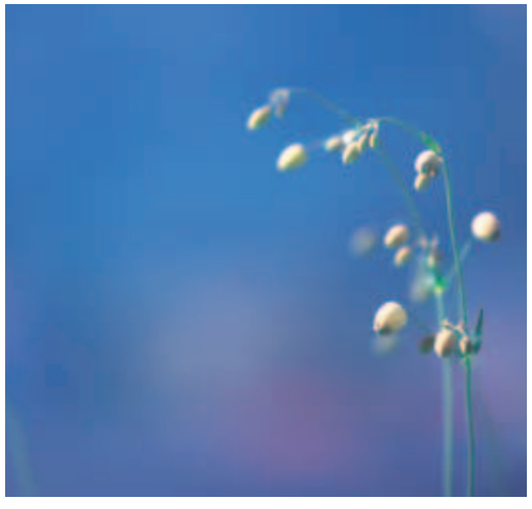
The depletion of the ozone layer is considered to be the main reason for higher effective intensities of UV radiation in our environment and for example the reason for more cases of cancer (e.g. melanoma). As a consequence problematic ODS have been banned in many countries for specific purposes (sprays, solvents) and should nowadays only be used in equipment, where they cannot be easily substituted and not get emitted continuously (e.g. fire extinguishers, refrigerators, heat pumps, etc.).

Reduction measures:

- Substitution of problematic ODS by less problematic ones or neutral gases.
- Careful handling and maintenance of installed equipment using ODS as a working fluid.
- Careful treatment and recycling of old de-installed equipment containing ODS.

Relevance:

ODS are for the pulp and paper production (except special coatings) not of relevance and consequently, usually are not measured and reported.



2.7 Methane [CH_4]

Origin:

Industrial Methane emissions for example occur because of the following reasons:

1) During oil exploration, if Methane coming from the underground gets released to the environment and not collected for utilization or flared.
2) Methane that is released during the distribution of natural gas (leaks, breaks).
3) Methane that gets formed in industrial processes (e.g. combustion processes).
4) Methane that gets formed in the environment under anaerobic conditions (landfills containing organic wastes).
5) Any newly formed organic material, which gets disposed on landfills certainly creates an additional potential for Methane emissions.

Within pulp and paper production minor emissions of Methane arise from combustion processes. Methane is also formed under anaerobic conditions for example during waste water treatment and always when organic waste materials get landfilled (e.g. sludge lagoons, sludge and bark landfills etc.). These emissions however cannot easily be measured or determined and are not of high relevance in comparison with other GHG emissions along the value-chain.

Methane emissions however are also formed at the end of the pulp and paper value chain, when paper products not get recycled (best case) or utilized for energy production (acceptable case) but get disposed together with other un-separated wastes on landfills (worst case), which has a significant negative impact on their overall footprint.

Environmental impact:

The GHG potential of Methane is considered to be 25 times higher than that of Carbon Dioxide. In addition Methane emissions can form explosive concentrations with air, which is especially important for responsible landfill management.

Reduction measures:

1) Emissions of natural gas during exploration and distribution certainly can be avoided by responsible operation of the facilities (BAT).
2) Emissions related to water treatment under unwanted anaerobic conditions can be avoided by appropriate operation and maintenance of these plants.
3) Emissions related to existing landfills can be minimized by making them stable (keeping them dry), by collection and combustion of landfill gases or by sending the landfilled material to controlled combustion or composting.
4) Emissions related to newly formed organic waste material can be avoided by any kind of material or energetic recycling, where the material will not degrade under uncontrolled conditions. In fact today besides others one of the main arguments for recycling of paper (and by that separating the fibre out of the otherwise landfilled waste stream) is the avoidance of unnecessary GHG emissions from landfills and the transformation of the material from a potential threat again into a highly valuable raw-material (recycled fibre), which can be used for many different purposes (paper, packaging, insulation, energy). The crucial role of the end-consumers behaviour regarding waste separation is important to mention in that context.

Relevance:

In terms of the pulp and paper production processes Methane emissions do not represent a relevant contribution to the overall GHG emissions and are consequently usually not reported.

2.8 Carbon-Monoxide

Not considered as a relevant parameter for reporting of key-performance.

2.9 Dioxines

Origin:

Dioxines within air emissions usually are formed when organic chlorine containing substances are combusted under uncontrolled conditions (low temperatures), but they even can recombine after highest combustion temperatures, when the flue gas cools down again slowly. Within pulp and paper mills this case could happen, if a mill with significant AOX emissions into the effluent, e.g. from Chlorine bleaching (see corresponding chapter AOX) would concentrate these emissions (e.g. the biological effluent treatment sludge) and send this material to uncontrolled incineration in a biomass boiler without appropriate flue gas treatment facilities.

Environmental impact:

See under respective chapter “AOX”.

Reduction measures:

ECF bleaching processes according to Best Available Technique (BAT) and TCF bleaching processes can reduce the emissions of AOX to an from environmental perspective acceptable extent, which also allows later on the combustion of the biological sludge in modern power boilers. If chlorinated organic substances are combusted appropriate combustion conditions and flue gas treatment facilities (flue gas washers, activated coal filters, etc.) can avoid the release of Dioxines.

Relevance:

In terms of the reporting of the environmental key-performance of pulp and paper mills Dioxines are only of relevance, if a Chlorine bleaching process is in place and/or substances with considerable contents of AOX are sent to combustion, which is not the case for state-of-the-art ECF and TCF pulp mills.

2.10 Acidification, acidification potential [acid rain]

Origin:

Acidification describes the negative environmental impact from acid gases that are released into the air or resulting from the reaction of non-acid components of the emissions. These are taken up by atmospheric precipitations and cause the phenomenon known as “acid rain”.

The acidification potential is described as the ability of certain substances to cause acidification, measured by their potential to build and release H+ - ions (H+ potential) expressed in terms of the H+ potential of the reference substance SO_2.

Environmental impact:

The acidic precipitation is absorbed by plants, soil and surface waters and leads for example to leaf damages of plants and the super acidity of the soil, which in turn affects the solubility and hence availability of plant nutrients and trace elements plants can take in. It can lead for example to an increased take up of heavy metals or reduced take up of some plant nutrients and hence negatively affect the growth of plants.

Reporting:

The acidification of air emissions from pulp and paper production does not need to be reported, since it can be calculated based on the reported SO_2 and NO_x emissions.

2.11 S, S_{tot} [Total Sulphur]

Origin:

S and S_{tot} respectively stand for the Total Sulphur emissions to air including both oxidized Sulphur (SO_2) and reduced Sulphur (TRS). See detailed explanations in the corresponding chapters “SO_2” and “TRS”.

2.12 Noise

Origin:

Like all large-scale production processes the pulp and paper industry by nature causes noise emissions.

Environmental impact:

Noise can have negative impacts to workers in the mill and often represents an annoyance to the surrounding community.

Reduction measures:

Noise can be avoided/reduced to a certain extent by isolating of equipment and specific working procedures. Furthermore, all employees are required to wear hearing protection when working in noisy environments. To protect the surrounding from unacceptable noise usually specific noise levels, which are set by the authorities, have to be met.

Relevance:

Although noise can be a relevant impact from the well-being perspective of employees and neighbouring communities, it is not considered as a key performance parameter from environmental perspective.

2.13 Radiation

Origin:

Although radioactive instruments are used for example for measuring of the level of materials in containers, the flow of material through pipes, the density of materials and the thickness of the paper on the paper machine, paper industry is usually not an emitter of problematic (e.g. radioactive) radiation as long as the basic rules for the handling of radioactive sources are kept.

Environmental impact:

Negative impacts to the environment out of the radioactive instruments can be avoided, if old radioactive equipment only gets disposed according to legislative requirements. Also risks for the health of employees can be eliminated, if the basic rules for handling of radioactive sources are met.

Relevance:

In comparison with other impacts from pulp and paper production emissions of radiation are not regarded as relevant from environmental perspective.

2.14 Malodorousness

Origin:

Within pulp and paper industry malodorousness is mainly formed during pulp production and waste water treatment by formation of TRS.

Environmental impact:

See detailed explanation in the corresponding chapter “TRS”.

Relevance:

Although malodorousness especially from Sulphate pulp production plants is certainly a relevant impact from the well-being perspective of employees and neighbouring communities, the malodorousness itself is not considered as a key performance parameter from environmental perspective. Also it is not easily possible to measure and weight the emission/impact of malodorousness because the level of annoyance is very subjective.

3. ENERGY EFFICIENCY

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Origin:

Pulp and paper making are both highly energy intensive processes. Besides a significant consumption of electrical energy for all the installed equipment needed for pulp and paper production also considerable amounts of thermal energy are needed mainly for the cooking and drying processes.

Environmental impact:

Energy consumption is in most cases connected with different air emissions from the combustion of fuels. Whereas in the past mainly the emissions of SO_2, NO_x and Particulates from energy generation have been in the spotlight, nowadays by far the CO_2-fossil emissions are considered as the most problematic impact related to energy consumption. Certainly also the problem of resource depletion is relevant in terms of energy consumption.

Reduction measures:

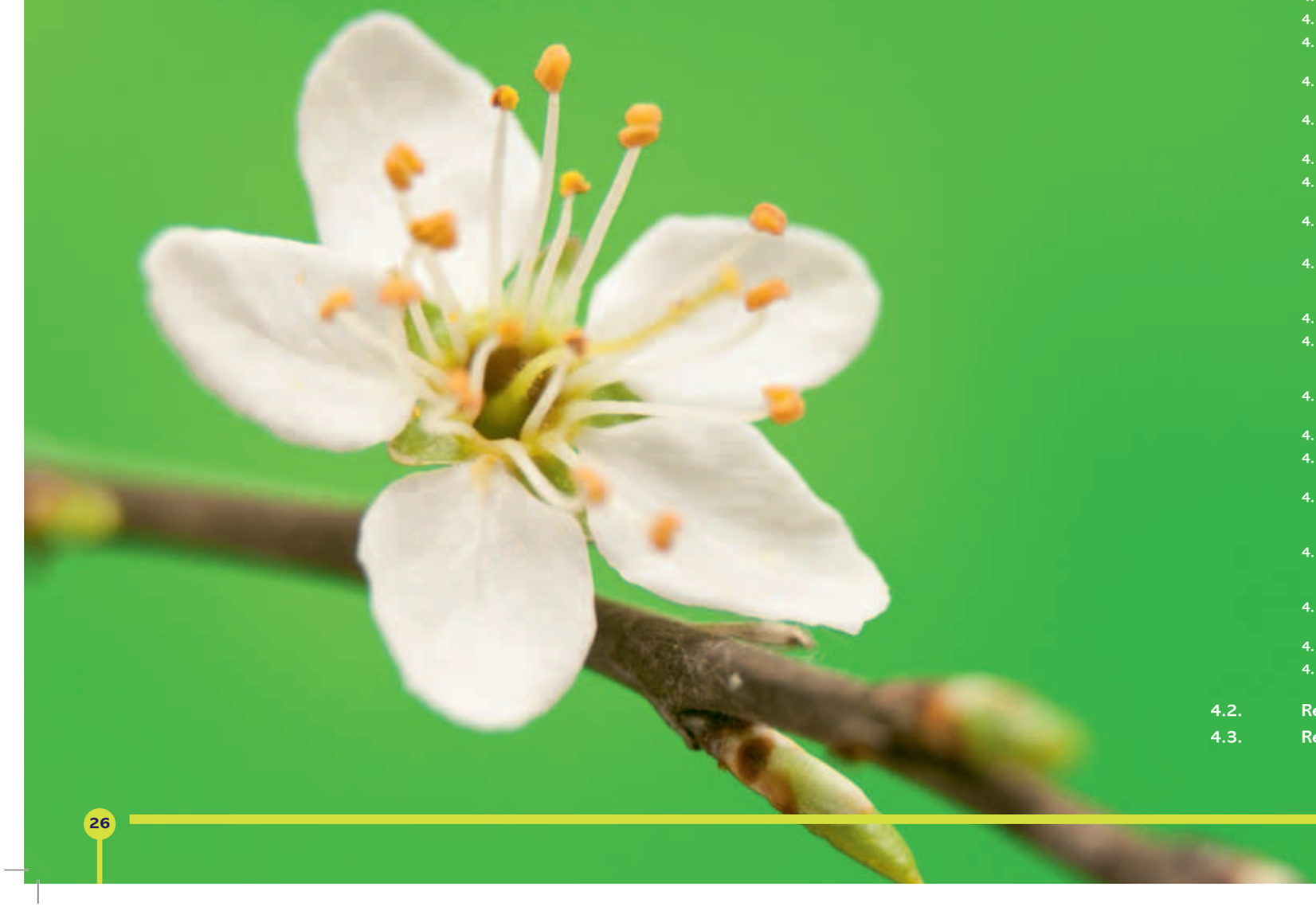
Efficient energy generation (esp.: co-generation), energy transport (insulation), energy application (e.g. dewatering and drying technologies) and energy recovery/re-utilisation (by heat exchange) are prerequisites for an efficient energy utilisation.

Relevance:

“Since both pulp and paper making are highly energy intensive processes, the achieved efficiencies related to energy conversion and application are of highest relevance.

Especially if the Carbon-Footprint is used for rating and benchmarking of the environmental performance of paper products, it must be considered, that a low Carbon-Footprint could be achieved just by substitution of fossil energy by biomass or other renewable energy, which does not necessarily mean, that also a high energy efficiency is applied. Because also the availability of renewable energy is limited it is important not only to promote and increase its application but to assure that it is utilized efficiently.

4. ENVIRONMENTAL MANAGEMENT SYSTEMS



4. ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS)

4.1 Relevant background information

The Environmental Management System is that part of the overall management system that includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy of the organisation.

There are two different standards which are of relevance for pulp and paper industry, ISO 14001 and EMAS.

Within a certified EMS the compliance of the organisation with the requirements of the respective standard is regularly checked by external auditors from accredited certification bodies and a certificate is issued by the certification body, which confirms compliance.

4.1.1 EMS Standards

4.1.1.1 ISO 14001

Within the ISO 14001 standard the requirements to an international recognized structured Environmental Management System (EMS) is defined. The overall target of ISO 14001 is, to promote the protection of the environment and to avoid adverse environmental impacts in accordance with socio-economic requirements. Differently to EMAS the ISO 14001 standard does not require the certified organisation to publicly report on its achieved environmental key performance.

4.1.1.2 EMAS

EMAS (Eco-Management and Audit Scheme) is a voluntary EMS based on EU regulations very similar to the ISO 14001 standard open to companies and organisations operating in the European Union. The objective of EMAS is to ensure continuous improvements in environmental performance by getting companies and organisations to commit themselves to monitoring and improving their own environmental impact.

The main difference to ISO 14001 is that EMAS certified companies additionally have to publish an “Environmental declaration”, which has to cover all environmentally relevant information about the operation and hence provides detailed information about the achieved environmental performance.

4.1.2 Main elements of an ISO/EMAS certified EMS

4.1.2.1 Environmental policy

A certified operation has to define an environmental policy which includes at least the following aspects:

- A commitment to continual improvement and the prevention of pollution.
- A commitment to comply with relevant environmental legislation and regulations and with all other requirements to which the organisation subscribes.

The environmental policy must become documented, implemented and maintained and communicated to all employees and it must be made available to the public.

4.1.2.2 Procedures to identify, control and assess the environmental aspects of the operation

All relevant environmental aspects of the operation have to be in the first step identified. For the pulp and paper industry the relevant environmental aspects would be for example:

- Formation of effluent/ Emissions to water
- Emissions to air
- Noise
- Malodorousness
- Formation of hazardous and non hazardous waste
- Consumption of raw materials
- Handling of hazardous and non hazardous chemicals
- Etc.

After identification procedures have to be defined which allow monitoring, measure and controlling these.

4.1.2.3 Procedures to identify and have access to legal and other requirements to which the organisation subscribes

A certified operation has to maintain a list of all relevant requirements coming mainly from local and national authorities but also from internal commitments. It must be documented that all these requirements are known by the responsible managers and met on a continual base. In case of non compliances to such requirements immediate corrective actions have to be defined, implemented and documented.

4.1.2.4 Environmental objectives and targets, at each relevant function and level within the organisation

Based on the identified environmental aspects a certified operation has to define environmental objectives and targets in order to continually improve its environmental performance.

4.1.2.5 Programme for achieving its objectives and targets

It is important that all agreed objectives and targets are measurable and that the responsibility for implementation, the required resources and time period are clearly defined. This information is usually summarised within the Environmental Programme of the operation.

4.1.2.6 Definition, documentation and communication of all roles, responsibilities and authorities

The detailed roles and responsibilities which are relevant to ensure compliance have to be defined documented and communicated to all employees.

4.1.2.7 Manager responsible for compliance with EMS requirements

It is necessary to appoint one or more specific management representatives, who have to ensure that the EMS requirements are established, implemented and maintained. Furthermore it is the obligation of the EMS responsible manager (“Environmental Manager”) to report on the performance of the EMS to the top management.

4.1.2.8 Procedures to ensure environmental trainings of employees or members at each relevant function and level

Relevant employees of each function and management level have to receive appropriate trainings which enable them to ensure compliance with the management system in their specific area.

4.1.2.9 Procedures for internal and external communication

There must be procedures in place which define how environmentally relevant information is communicated within the organisation but also to all external stakeholders.

4.1.2.10 Relevant information in paper or electronic form, which describes the management system and provides direction to related documentation

The management system, its relevant procedures and working descriptions have to be documented either in paper or electronic form (e.g. intranet) and must be accessible to all relevant employees having certain responsibilities.

4.1.2.11 Procedures for controlling of all documents required by the standard

There must be procedures in place which define how management system relevant documentation is systematically updated and distributed to responsible employees in order to ensure that only the currently valid documentation is being used.

4.1.2.12 Preventive measures

Procedures have to be established to cover situations where their absence could lead to deviations from the environmental policy and objectives (procedures, working descriptions).

4.1.2.13 Procedures to identify potential for and respond to accidents and emergency situations

Certified operations have to identify potential emergency situations and to define preventive actions to avoid as well as corrective actions to most efficiently handle them.

4.1.2.14 Procedures to monitor and measure the key characteristics of its operations and activities, that can have a significant impact on the environment

Based on the present environmental aspects those activities that can have a significant impact on the environment have to be identified and procedures have to be established to monitor and measure these impacts in order to support their continual improvement.

4.1.2.15 Procedures for handling of non-conformances and for initiating and completing of corrective and preventive actions

There must be procedures in place to firstly identify non-conformances, report them to the responsible managers and define appropriate corrective and preventive actions.

4.1.2.16 Procedures for the identification, maintenance and disposition of environmental records

There must be procedures in place which regulate what kinds of environmental records have to be maintained and where/for how long such records have to be stored.

4.1.2.17 Procedures and programmes for periodic EMS audits

The compliance with the EMS has to be regularly audited by internal staff (internal audits) and all kinds of identified non-compliances, improvement potentials have to be reported and corrective / preventive actions defined.

4.1.2.18 Review of the EMS by the top management, to ensure its continuing suitability, adequacy and effectiveness

A summary of the results of the internal audits ("Management Review") has to be reported to top management for review in order to ensure the continuing suitability, adequacy and effectiveness of the EMS.

4.2 Relevance

The presence of a certified EMS not necessarily means, that the operation already achieves a high environmental performance, but it provides assurance, that all necessary elements, which allow the responsible management of potential environmental impacts from the operation, have been implemented and a continuous improvement process is in place. Consequently the presence of a certified EMS is of highest relevance, although it does not necessarily mean a high environmental performance.

4.3 Reporting of EMS information

EMS information in any case needs to be reported, since it is highly relevant.

However, there is currently no clear standard, how an "EMS coverage figure" should be reported, if for example not the full value-chain is covered by an EMS.

(1) The paper mill is certified, but not the supplying pulp mill.

(2) The paper mill is not certified, but the supplying pulp mill is certified.

(3) The paper mill is certified, has 3 pulp suppliers, of which only the main one (delivering 70% of the total supply) is certified.

A reasonable "EMS coverage factor" could be defined as follows:

First it is necessary to determine the relevance of the pulp and paper production processes in terms of this parameter.

(1) On the one hand pulp production has a much higher direct environmental impact, since emissions of pulp production are much more relevant than of paper production.

(2) On the other hand paper production has a much higher indirect impact, since within paper production also pulp purchasing of course should be covered by the EMS, which means, that overall performance can be significantly influenced by the purchasing decision.

(3) Consequently the decision to weight both processes as equally relevant (50%) seems to be logic.

The balanced EMS coverage factor according to the above examples would be:

(1) EMS = 50 + 0 = 50%

(2) EMS = 0 + 50 = 50%

(3) EMS = 50 + 50*0,7 = 85%

5. CARBON FOOTPRINT

5. CARBON FOOTPRINT

5.1 Relevant background information [FAQ]

The "Carbon Footprint" is a relatively new environmental topic, which currently gets more and more awareness among many interested stakeholders of the pulp & paper value-chain.

Consequently not only the requests to determine and report the Carbon Footprint will increase rapidly but also many questions in relation to the Carbon Footprint can be expected.

5.1.1.1 What is the meaning of the term "Carbon Footprint"?

Under the term "Carbon Footprint" we understand the total impact to the environment by emissions of Carbon dioxide from fossil origin and other Greenhouse gas (GHG), such as Methane and Nitrous Oxide, along the life-cycle of a product.

- Usually for the determination of the Carbon Footprint all other GHG emissions than CO_2 are recalculated to "equivalent Carbon dioxide emissions" and added to the fossil Carbon dioxide emissions.
- Carbon dioxide emissions of biogenic origin (such as from the utilisation of wood for energy production) usually do not get considered in the Carbon Footprint, because under the assumption of sustainable forest management they can be regarded as "climate neutral" (biomass as a renewable fuel source).

5.1.1.2 Is the Carbon Footprint of relevance in terms of environmental protection and sustainable development?

According to the current status of science the global warming (caused by the utilisation of fossil fuels by mankind) is regarded as the by far most serious problem from the perspective of ecological sustainability. In other words, the capacity of the planet to absorb the GHG emissions is from current point of view the biggest bottleneck.

5.1.1.3 Is the Carbon Footprint a meaningful measure for the environmental performance of paper products?

Since the Carbon Footprint is more and more also used for the ecological comparison/benchmarking of products, but only considers one environmental aspect namely the GHG emissions, this question is indeed legitimate.

Generally the Carbon Footprint is only a meaningful measure for the environmental performance of products, if the emissions of GHGs represent the most important or at least a relevant/characteristic environmental impact of the specific product.

For paper products this is actually the case, since pulp and paper production is a very energy- and transport intensive process.

5.1.1.4 What is the influence of product use and final product disposition on the Carbon Footprint?

In fact product-use and final product-disposition have an enormous influence on the overall Carbon Footprint of paper products, which needs to be further explained:

The use of the product is long-lasting

Long-lasting products (paper used for archiving, books, construction material) act as carbon sink/carbon storage as long as they exist. No further emissions are caused during product-use and the conserved carbon can be considered positively in the overall balance. In case of energy efficient paper products this can even mean, that more Carbon is bound in the product than gets released along the life-cycle, however only a small portion of the total paper production is used for long-lasting products.

The product gets again recycled to paper

In this case the carbon bound in the product also does not get released (with exemption of the losses during recycling) and is transformed into a new product. Of course additional emissions are caused during the recycling process, but considerably less energy is used in comparison with sourcing the same product from primary raw-materials. In addition Methane emissions from landfilling of paper are avoided.

The product gets combusted under utilisation of the energy

During combustion the remaining value creation of the product (e.g. recyclable fibre) gets destroyed and the carbon is released in the short term, but at least the energy content of the material gets utilised.

In comparison with the uncontrolled degradation of biomass on landfills (Methane formation) this causes less GHG emissions and some fossil energy can be substituted, which again means a positive impact on the Carbon Footprint.

In comparison with recycling however, where significant energy consumption can be avoided indirectly by replacing virgin material, the combustion of paper is in most cases of lower environmental benefit.

The product gets landfilled together with other wastes

This scenario represents the worst case, since during degradation of the organic material in the landfill besides Carbon dioxide also Methane is formed, which has the potential to significantly increase the overall footprint of the product.

5.1.1.5 Of what magnitude is the Carbon Footprint of paper products and what are the most relevant influencing factors?

If the very important impact from final product disposition is excluded, usually the energy efficiency of the production plants but also the transport of the main raw-materials and the product itself are the most influencing factors. In comparison the emissions from forestry operations are of less importance as well as the indirect emissions associated with (in terms of consumption) less relevant raw-materials and chemicals.

5.1.1.6 What are the problems, limits and risks in utilizing the Carbon Footprint as a performance measure?

Generally the Carbon Footprint should represent the GHG emissions of the full life-cycle of the product. In practice however often only specific parts of the life-cycle are considered or different assumptions have to be taken, because

1) Data is not available or limited.
2) It is not possible to clearly determine relevant aspects of the actual life-cycle of the product (especially during and after product-use).

Consequently only in specific cases the Carbon Footprint can be used for product comparisons:

Problem – "Footprints are not equally defined"

(1) Different balance-rooms

In the case of paper products with the main raw-materials wood and recovered paper the following process steps have to be assessed regarding both direct and indirect GHG emissions along the products life-cycle.

- Forest Management (reforestation, silviculture, wood harvesting)/ separation and collection of recovered paper.
- Transport of wood/recovered paper (and other raw materials) to the pulp mills/recycling plants.
- Emissions from production and transport of all other purchased raw-materials and chemicals, which are needed for pulp production.
- Pulp production (virgin or recycled).
- Transport of pulp (and other raw-materials) to the paper mill.
- Production of paper.
- Emissions from production and transport of all other purchased raw-materials and chemicals, which are needed for paper production.
- Further paper converting processes and related transports.
- Transport of the final product to the customers.
- Use of the product by the customer.
- Disposal of the paper after use.
  - Long-lasting use such as archiving, books (= conservation)
  - Recycling
  - Combustion with energetic utilisation
  - Combustion without energetic utilisation
  - Land filling

In practice the emissions of certain steps are insufficiently known, which means, that either assumptions have to be taken or that they are simply excluded from the assessment. Other emissions are not considered as relevant and get excluded from the assessment from the very beginning.

(2) Different consideration of indirect emissions

Besides the direct emissions along the value-chain also indirect emissions from purchased raw materials, chemicals but also end-energies have to be considered. Usually nowadays within most Carbon Footprint evaluations indirect emissions from purchased energy and the most important raw materials are considered, those from less-relevant raw-materials and chemicals however are excluded, because of the high complexity and their compared to other emissions minor relevance.

(3) Different consideration of by-products

In the case of product-specific Carbon Footprint evaluations it is necessary to allocate the total emissions of the value-chain to all kinds of different products and by-products, which means on the one hand a significant effort on the other hand there are many different methodologies to do so, which makes the comparability even more complicated.

(4) Different assumptions regarding product-use and product-disposal

- The main problem for product-specific Carbon Footprint calculations is the uncertainty regarding the final disposition of the product, because in most cases very different scenarios to an often not known extent are possible, which again means a variety of possible assumptions.
- Besides the missing information about the final disposition also there is uncertainty how degradable products behave under specific conditions over long time. (E.g. the extent of formation of CO_2 and CH_4 out of the degradation of different materials on landfills).

Limits: Lacking comparability and transparency

Because of lacking standardisation regarding product-specific Carbon Footprint determination, Carbon Footprint figures from different sources in most cases cannot be compared/benchmarked.

Weaknesses

(1) Ensuring of sustainable forestry

For most Carbon Footprint calculations of wood based products the sustainability of the forestry management is taken as granted, which not necessarily is the case. Consequently the ensuring of sustainable forest management by forest certification is of highest importance.

(2) Actual disposition of the products after use

Because of the problematic uncertainty of the actual disposition of the products after use and the associated significantly different impact on the Carbon Footprint, this aspect is usually excluded. However this aspect of the life-cycle is from essential importance for the overall sustainability of the value-chain. It is for example useless to buy the paper with the lowest production footprint and at the same time not caring for the recycling of the product after use. The loss of energy that comes along with not recycling of paper is significantly higher than the energy savings that can be achieved by an optimized/energy-efficient production.

(3) Indirect climate-positive advantages of products

Often the indirect climate-positive advantages of products, such as their potential to substitute other more energy-intensive products are not considered adequate, which can result in misleading or even wrong conclusions.

(4) Exclusion of other not climate-relevant environmental impacts

A systematic weakness of the Carbon Footprint is of course, that only GHG emissions are
in the focus and other in some instances significant and very specific environmental aspects are not considered and get neglected.

Risks

The main risks associated with the utilisation of the Carbon Footprint as a key performance parameter are consequently false conclusions because of:

1) Inadequate consideration of indirect climate-relevant aspects.
2) Inadequate consideration of non climate-relevant environmental aspects.
3) The comparison and benchmarking of footprint figures, which are not at all comparable.

5.2 Reporting of Carbon Footprint information

If CF information is reported and used for product comparisons, it is of highest importance, that the reported figures are generated in a uniform/standardised way.

In this respect there are currently 2 standards available, which define in more detail how the Carbon Footprint of products should be determined:

1) The framework for the development of Carbon Footprints for paper & board products from the Confederation of European Paper Industries (CEPI)
2) The Specification for the assessment of the life cycle greenhouse gas emissions of goods and services (PAS 2050:2008) from British Standards (BSi)

Generally, whenever assumptions are taken or the calculation is based on average emission

factors or figures from Life Cycle Inventory databases and not on specific data, a brief description/rationale should be enclosed in order to ensure the highest possible transparency.

Also it has to be clearly defined, which parts of the life-cycle are covered by the calculation and which parts have been excluded from the assessment.

6. CHEMICALS

6. CHEMICALS

6.1 REACH

There are a huge number of potential questions related to the chemicals, which are used for pulp and paper production.

At this stage the "Environmental Guide for pulp and paper production" only addresses those of highest relevance, which have been raised by interested stakeholders.

6.1.1 Background information

REACH refers to the new chemicals regulation of the European Community, Regulation (EC) Nr. 1907/2006, which came into force on June 1st 2007. Since numerous questions regarding the applicability of this new regulation to the pulp and paper industry and the associated obligations have been raised, some background information as well as answers to the most important questions shall be provided.

6.1.1.1 What does the term 'REACH" mean?

The term REACH stands for "Registration, Evaluation, Authorisation and Restriction of Chemicals" and refers to the to the new chemicals regulation of the European Community, Regulation (EC) Nr. 1907/2006. According to this regulation it is allowed only to market such chemicals within the European Union, which have been registered by the producers or importers before. Besides registration the REACH regulation foresees a systematic process of evaluation of these chemicals and if necessary requires an authorisation and restriction of certain chemicals.

6.1.1.2 How do the REACH mechanisms of "Registration, Evaluation, Authorisation and Restriction of Chemicals" work?

From June 1st 2008 until December 1st 2008 producers and importers of specific substances have the opportunity for pre-registration. The aim is to support the creation of forums, in which different producers and importers of equal or similar substances can exchange information. In return to the pre-registration, which is free of charge, the producers/importers get an extension of the time for the registration, depending on the quantities and properties of the corresponding substances.

The pre-registration itself is not obligatory, but if the producers/importers don't use it, from December 1st 2008 the principle "no data, no market" becomes valid, which means, that they are not allowed to market those substances, which have not already received full registration.

During the registration the producers/importers have to provide extensive information regarding the substances, which includes for example information about classification, marking, production and save usage as well as exposition, toxicology and eco-toxicity. In order to minimise animal experiments, which can be necessary to provide this information, the producers/importers always have to check, whether respective studies are not already available.

Verification of completeness/ Evaluation

After provision of the materials for registration by the producer/importer to the European Chemicals Agency (ECHA) a verification regarding completeness is performed. It is checked, whether the fees have been paid and whether all required information has been provided. For the following risk evaluation of the substances the ECHA elaborates a working plan until December 1st 2011, where according to a risk based concept substances with higher risks are prioritised.

The substances afterwards have to be evaluated by the member states, which are the responsible authorities for that task. Depending on the result of the evaluation a process of authorisation or restriction can be required or in the case of insufficient information further information can be requested.

Procedure of authorisation

If the evaluation comes to the conclusion, that a substance is of certain concern, the substance gets included on a so called "candidate list". The ECHA afterwards has to decide, whether or not the substance also gets listed in Annex XIV of the REACH regulation as a "substance of very high concern", which needs authorisation.

The aim of the authorisation is an appropriate management of the risks of substances of very high concern and a stepwise substitution of such substances by alternative substances, if this is possible from economic and technical perspective.

If the producer/importer applies for the authorisation, the application has to include an assessment regarding alternative substances considering their risks and the technical and economic feasibility of the substitution. The commission will only authorise a substance, if the risks for health and the environment can be managed in an appropriate way. This is the case, if evidence can be provided, that the exposition will be below certain levels. If these levels cannot be determined or are exceeded, the authorisation will only be provided, if no adequate alternative substances or technologies are available and the socioeconomic benefit prevails; the risks of utilisation.

Procedure of restriction

The commission can, if proposed by the ECHA and the member states, also define restrictions regarding the production, the trade and utilisation of certain substances of high concern, which will be included in Annex XVII of the REACH regulation. This can mean for example, that certain substances are only allowed for specific purposes of application or under specific preconditions.

6.1.1.3 Which raw-materials and aids for paper production need registration

Generally most of the aids for pulp and paper production will require registration according to REACH. However, for certain main raw-materials there are exemptions from registration, because they are of natural origin and not classified as dangerous.

These are in particular:

- all kind of cellulose pulps
- starch
- limestone
- different kinds of fillers and pigments
- wood (round wood and chips)
- recovered paper.

6.1.1.4 Are paper products obligatory for registration?

Paper products are articles according to REACH and consequently not obligatory for registration.

However, if a paper article is produced with intentional release of a substance under normal or reasonably foreseeable conditions of use (e.g. perfume) and this substance is present in the produced paper article in quantities totalling over 1 ton per producer or importer per year, the substance requires registration, if not already registered for that use.

Also, if any individual "substance of very high concern" is present in a produced paper article above 0.1% weight by weight (i.e. 1000 parts per million) and the substance is present in the produced paper articles in quantities totalling over 1 ton per producer or importer per year, the producer/importers will have to notify the substance to the European Chemicals Agency. The Agency then, if certain preconditions are in place, can decide that the producer/importer has to apply for a registration for this substance in the respective article.

In this case there is also the duty for the producer/importer/supplier to communicate to customers and respond to consumers of this article on the presence of such substances and to provide all available information for a save utilisation of the article.

In the case of paper products however, it is most likely the case, that none of the "substances of very high concern" will be present above 0.1% weight by weight, if the common production processes, raw-materials and aids are being utilised.

6.1.2 Reporting in terms of REACH

Considering the duties for producers/importers/suppliers of articles as defined in the REACH regulation, they only have to report to their customers and respond to consumers, if any individual "substance of very high concern" is present in a produced article above 0.1% weight by weight (i.e.1000 parts per million) and the substance is present in the produced articles in quantities totalling over 1 ton per producer or importer per year.

Nevertheless many customers do request confirmation from their suppliers, that all requirements according to the REACH regulation are fulfilled.

7. SUSTAINABLE FORESTRY

7. SUSTAINABLE FORESTRY

7.1 Relevant background information

Since a significant proportion of all environmental questions coming from all kind of different stakeholders nowadays are devoted to "Sustainable Forestry", a more detailed description of related systems, certifications and special terms shall be provided.

7.1.1 The term "Sustainable Forestry"

The term "sustainable" historically was first used in forestry management, where the understanding of a "sustainable practice" was not to harvest more forestry resources that could in terms of quality and quantity be regenerated in the same time.

In the understanding of sustainability today besides the value of the forests of generating wood and biomass also their numerous other benefits and values have to be respected and protected.

Besides being the supplier of biomass for material and energetic utilisation forests are:

- In many places of the earth the exclusive base for life/source of income for communities and indigenous people out of for example hunting, collecting mushrooms and berries, but also tourism.
- Protecting communities from natural disasters (like avalanches and mudflows in the mountainous regions).
- The bio-top of many creatures (animals and plants) and bear the highest biodiversity on earth.
- Protecting the soil from erosion and maintaining our water resources and by that avoiding desertification.
- Providing a natural recreation area.
- Representing a relevant carbon sink (stored carbon in the forest) and an efficient mechanism to bind additional CO_2 from the atmosphere.

Forests, which do provide specific conservation values are called High Conservation Value Forest (HCVF). "Sustainable forestry" from today's perspective consequently means also to put highest efforts in place to either protect such HCVF or only manage them in a specific way, which respects or even maintains their specific conservation value.

7.1.2 Forest certification

Forest certification can be regarded as a tool to ensure Sustainable Forestry. By forest certification a certain Minimum Standard in terms of sustainable forestry practices has to be implemented within forestry operations. Within a credible certification standard the application of these sustainable forestry practices is controlled/checked and documented via regular re-certification audits by independent certification bodies.

Besides systematic ensuring of compliance with local forestry laws and regulations a continual improvement process becomes implemented, which should identify areas for improvement and lead to implementation of corrective actions and if possible precautionary measures.

Besides the opportunity to support and accelerate the implementation of sustainable forestry practices in the field another big potential, that comes along with forestry certification, is the Chain-Of- Custody (COC) certification and product certification.

7.1.3 Chain-Of-Custody (COC) certification

COC certification can be regarded as the tool to promote sustainable forestry.

Credible forest certification allows also to introduce a certification of the total value chain, the "Chain of Custody" (=COC). The source of the material/product can be traced back from the final product along all steps of production and manipulation to the certified forest of origin.

A fully certified chain of custody allows to mark products as certified (product certification) providing assurance, that only raw-materials according to the COC-certification requirements have been used for production of the product.

COC-certification provides to all of the stakeholders (forest owners, producers, traders, consumers) the following advantages:

- Differentiation between uncertified and certified products of different certification standard.
- Empowerment of all stakeholders to contribute actively to a more sustainable value chain (by choosing/promoting and also rewarding products fulfilling a certain Minimum Standard in sustainable practise).

7.1.4 Plantations versus Natural Forests

Interestingly there are commonly two fully opposite positions regarding plantations both based on environmental arguments:

(1) Position "Pro plantation"

- Natural forests due to their high biodiversity should be protected as far as possible.
- Plantations have a much higher wood/fibre yield and can provide needed raw materials more efficiently.
- Plantations should preferably used as a wood and fibre source in order to reduce the pressure on natural forests.

(2) Position "Contra plantation"

- Plantations are mostly monocultures having both negative environmental and social impacts and are created mainly by conversion of natural forests.
- Because of their negative impact plantations should be avoided and wood and fibre should be preferably sourced from managed natural forests.

In order to determine, whether one of the above positions is really correct some more background information is necessary. In any case many questions and concerns exist about plantations, of which the most important ones shall be discussed briefly in the following chapter.

7.1.4.1 What is currently worldwide the ratio of plantations versus natural forests?

Region	Land area [million ha]	Total Forest [natural forests and forest plantation]			Natural Forest [million ha]	Forest Plantation [million ha]
		Area (millions ha)	% of land area	% of world's forests		
Africa	2978	650	22	17	642	3
Asia	3085	548	18	14	432	116
Europe	2260	1039	46	27	1007	32
North and Central America	2137	549	26	14	532	18
Oceania	849	198	23	5	194	3
South America	1755	886	51	23	875	10
World total	13064	3869	30	100	3682	187

Source: FAO, State of the world's forests

www.fao.org/forestry/sofo/en/

According to the FAO in 2000 worldwide about 3869 Mio. ha of land were covered with forest, of which 3682 Mio. ha (= 95%) were natural forests and 187 Mio. ha (= 5%) were forest plantations.

7.1.4.2 What are the most common concerns about plantations?

1) Plantations may be the reason for the reduction of natural forests of high biodiversity.
2) Plantations cause a reduction of biodiversity and a loss of habitat.
   a. Since plantations are usually large-scale monocultures they result in a reduction of biodiversity and a loss of habitat.
   b. Plantations may include introduced trees not native to the area causing further biodiversity loss.
3) Plantations may include genetically modified trees.
4) Plantations may require the intensive application of fertilisers and/or pesticides.
5) The replacement of natural forest with tree plantations may also cause social problems.
   a. Conversions of natural forest are made by with little regard for rights of the local people.
   b. Plantations established purely for the production of fibre provide a much narrower range of services then the original natural forest for the local people.

7.1.4.3 Are plantations the main reason for the loss of natural forests?

Domain	Natural forest					Forest plantations			Total forest
	Loss			Gain	Net change	Gain		Net change	Net change
	Deforestation	Conversion to forest plantations	Total loss	Natural expansion of forest		Conversion from natural forests	Afforestation		
Tropical areas	-14.2	1.0	15.2	+1.0	14.2	+1.0	+0.9	+1.9	-12.3
Non-tropical areas	-0.4	-0.5	-0.9	+2.6	-1.7	+0.5	+0.7	+1.2	+2.9
World	-14.6	-1.5	16.1	+3.6	-12.5	+1.5	+1.6	+3.1	-9.4

Source: FAO, State of the world's forests

- From 1990 – 2000 the world-wide area of plantations increased by 3.1 Mio. ha, of which 1.5 Mio. ha were converted from natural forests and 1.6 Mio. ha were afforested.
- From 1990 – 2000 the world-wide area of natural forests decreased by 12.5 Mio. ha, of which 1.5 Mio. ha were converted to plantations and 11 Mio. ha were deforested.
- From 1990 – 2000 about 7% of the natural closed forest being lost in the tropics is land being converted to plantations. The remaining 93% of the loss is land being converted to agriculture and other uses. Worldwide, an estimated 15% of plantations in tropical countries have been established on closed canopy natural forest.
- However, there are regions with significantly different trend in terms of natural forest conversion: From 1980 to 2000, about 50% of the 1.4 million hectares of pulpwood plantations in Indonesia have been established on what was formerly natural forest land.

Conclusion:

In specific geographical regions plantations might be one of the main reasons for conversion of natural forests, however globally forest plantations cannot at all be regarded as the main contributor to natural forests conversion.

7.1.4.4 Can plantations reduce the pressure on natural forests?

Although forest plantations accounted for only 5 percent of global forest cover in 2000, it is estimated that they supplied about 35 percent of global roundwood. (Source: FAO, Global Forest Resources Assessment 2000)

- Wood production on a tree plantation is generally higher than that of natural forests. While natural forests managed for wood production commonly yield between 1 and 3 cubic meters per hectare per year, plantations of fast-growing species commonly yield between 20 and 30 cubic meters or more per hectare annually.

Conclusion:

Plantations usually provide a significantly higher yield than natural forests and consequently have the potential to reduce the pressure on natural forests.

7.1.4.5 Do plantations necessarily contribute to a loss of biodiversity?

Plantations are usually large-scale monocultures and result in a reduction of biodiversity and a loss of habitat.

Plantations may include introduced trees not native to the area causing further biodiversity loss.

- Plantations are usually monocultures, where the same species of tree is planted in rows across a given area, whereas a conventional forest would contain far more diverse tree species.
- Since the primary interest in plantations is to produce wood or pulp, the types of trees found in plantations are those that are best-suited to industrial applications. (fast growth rate, specific quality for paper and timber production.)
- If natural forest is cleared for a planted forest then a reduction in biodiversity and loss of habitat will most likely result.
- If a plantation is established on abandoned agriculture land or highly degraded land, it could result in an increase in both habitat and biodiversity. A planted forest can be profitably established on lands that will not support agriculture or suffer from lack of natural regeneration.
- Where non-native varieties or species are grown, few of the native fauna are adapted to exploit these and further biodiversity loss can occur.
- However, even non-native tree species may serve as corridors for wildlife and act as a buffer for native forest, reducing edge effect (negative effects, which can arise if undisturbed natural ecosystems are closely located to disturbed unnatural systems).
- Generally plantations can be managed in away, where a compromise between productivity and biodiversity protection is made. E.g.:
  - In the case of exotic species the habitat can be improved significantly if the impact is mitigated by measures such as leaving blocks of native species in the plantation or retaining corridors of natural forest.
  - If plantations are managed according to certain standards (e.g. FSC) possible negative impacts have to be addressed and High Conservation Value Areas have to be identified and protected systematically.

Conclusion:

The negative impact of reduction of biodiversity and loss of habitat is obviously valid for plantations that are established by conversion of natural forest land, but not necessarily for all plantations. Negative impacts can be reduced to an acceptable level by appropriate plantation management standards.

7.1.4.6 To what extent do plantations include genetically modified trees?

- Although the usage of genetically modified trees might be seen as an opportunity to mitigate future challenges, there are also relevant risks and threats associated with them.
- Currently genetically modified trees are still not commonly used on industrial plantations. So far only in China plantations based on GMOs have been established on a big scale.
- The FSC standard for example generally excludes the usage of genetically modified trees.

Conclusion:

Genetically modified trees can but are not necessarily associated with plantations. Nowadays plantations based on GMOs are still a clear exemption. Certain standards can ensure that genetically modified trees are not used.

7.1.4.7 To what extent do plantations require the intensive application of chemical fertilisers and pesticides?

- The need for usage of chemical fertilisers and pesticides is very much dependent on the specific local conditions.
- There are examples of critical conditions, where the usage of fertilizers and pesticides in order to prevent pests, diseases and invasive plants is acceptable even from ecological point of view, however their usage should always be the last step and restricted as far as possible.
- The FSC standard generally restricts the usage of pesticides:
  - Measures shall be taken to prevent and minimise outbreaks of pests, diseases, fire and invasive plant introductions. Integrated pest management shall form an essential part of the management plan, with primary reliance on prevention and biological control methods rather than chemical pesticides and fertilisers. Plantation management should make every effort to move away from chemical pesticides and fertilisers, including their use in nurseries.

Conclusion:

Negative impacts from intensive application of fertilisers and pesticides can be avoided, if the plantations are managed under certain standards.

7.1.4.8 To what extent do plantations cause social problems?

- There are negative examples, where tree plantations caused social problems related to
  - Violation of the rights of the local people
  - Decrease of the range of services of plantations compared to the original natural forest for the local people
- However, there are also very positive examples, where social problems could successfully be avoided and even advantages for local people could be realised.
- Again the question, whether plantations are causing social problems is very much dependent on the standards according to which the plantations are managed:
  - The systematical protection of tenure and use rights (FSC principle Nr. 2) as well as indigenous peoples rights (FSC principle Nr. 3) are fundamental principles of the FSC standard.
  - Also the problem of limited services of plantations for local people is well addressed in FSC's principle Nr. 5 "Benefits from the forest": Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

Conclusion:

Social problems such as negative impacts to local people can be avoided if the plantations are managed under certain standards.

7.2 Forest Certification Standards

7.2.1 FSC [Forest Stewardship Council]

The Forest Stewardship Council (FSC) is an international organization that brings people together to find solutions which promote responsible stewardship of the world's forests. Through consultative processes, it sets international standards for responsible forest management. It accredits independent third party organizations who can certify forest managers and forest product producers to FSC standards. Its trademark provides international recognition to organisations that support the growth of responsible forest management. Its product label allows consumers worldwide to recognize products that supports the growth of responsible forest management. FSC undertakes marketing programs and information services that contribute to the mission of promoting responsible forestry worldwide.

Further information:

- FSC-Website - http://www.fsc.org
- Website supporting the FSC certification system - http://www.whyfsc.com"

FSC certification

FSC certification is carried out by FSC accredited certification bodies. FSC itself does not certify forest operations or manufacturers. This maintains FSC's independence between its standards and requirements and operations seeking certification. FSC provides monthly updates on the certificates issued by FSC accredited certification bodies. There are two types of FSC certification, the FSC Forest Management (FM) Certification and the FSC Chain-Of-Custody (COC) Certification.

Further information:

- FSC registered certificates - http://www.fsc-info.org

FSC Forest Management (FM) Certification

Forest management certification involves an inspection of the forest management unit by an independent FSC accredited certification body to check that the forest complies with the internationally-agreed FSC Principles of Responsible Forest Management.

If the forest complies with FSC standards the FSC accredited certification body issues a certificate for the operation. Certified forest operations can claim the forest products they produce come from a responsibly managed forest.

Before a certified forest operation can sell their products as FSC certified, they must also obtain chain of custody certification (FM/COC).

An important aspect in terms of transparency of FSC certification is, that all FM certification reports have to be made publicly available, which is done by the accredited certification bodies.

FSC Chain-Of-Custody (COC) Certification

Chain of custody certification provides a guarantee about the production of FSC certified products. Chain-of-custody is the path taken by raw materials from the forest to the consumer, including all successive stages of processing, transformation, manufacturing and distribution. From a customer perspective, the FSC label represents a promise that is being made to them. Chain of custody standards are the mechanism FSC has to ensure that 'promise' is delivered. Operations that have been independently verified for FSC chain of custody certification are eligible to label their products with the FSC logo.

In terms of FSC COC certification nowadays 3 systems are differentiated:

1) The Percentage System
2) The Credit System
3) The Transfer system

FSC COC – Multisite Certificate

A COC "Multisite Certificate" means, that for example not only one central organisation is included within the scope of the certificate, but also for example defined sales offices or other distributions channels.

The advantage of a "Multisite Certificate" is that unnecessary certification and auditing efforts and costs can be reduced or avoided, if similar and related organisations are covered by one certificate.

FSC Controlled Wood Standard/ Controversial sources

FSC Controlled Wood Standard/Controversial sources

The FSC Controlled Wood Standard defines controversial wood sources, which are not allowed to be used for production of certified products from Mixed Sources. These are as follows:

1) Wood harvested from forest areas where traditional or civil rights are violated
2) Wood harvested from not FSC-certified forest areas having high conservation values which are threatened
3) Wood harvested from genetically modified trees (GM)
4) Illegally harvested wood
5) Natural forests that have been converted to plantations or non-forest use

The standard also defines the necessary procedures, which have to be implemented in order to systematically exclude such controversial sources from certified products.

7.2.1.1 FSC Labelling Standards

In the following, definitions are provided that apply for key terms relating to this standard. These terms are put in *italics* throughout the standard. Cross-references are provided to related terms.

Assembled products
Products that are constructed from two or more *solid wood* and/or ***chip and fibre*** components, assembled together to form another product. Examples include furniture, shelving units, musical instruments, plywood, blockboard, laminated veneer lumber, laminated flooring, laminated particle board, and printed materials containing different paper stocks.

Claim period
A period of time which has been specified by the *organization* for each product group for the purpose of making a specific *FSC claim*.

Chain of custody
The path taken by raw materials, processed materials, *finished products*, and co-products from the forest to the consumer or (in the case of *reclaimed*/ recycled materials or products containing them) from the reclamation site to the consumer, including each stage of processing, transformation, manufacturing, storage and transport where progress to the next stage of the supply chain involves a change of ownership (independent custodianship) of the materials or the products.

Chain of Custody operation
Individual, company or other legal entity operating one or more facilities or *sites* within any 'stage' of the forest product supply chain and issuing invoices for materials or products with an *FSC claim* that can be used by customers to treat such products as certified or make *promotional* claims. *(Chain of Custody)*

Chip and fibre products
All products that use input-wood that has been chipped or defibrillated. Such products include, for example, pulp, paper (including print materials), cardboard, particleboard, fibreboard and orientated strand board (OSB). *(Assembled products, Solid wood products)*

Co-product
Material produced during the process of *primary manufacturing* of another (principal) product, from the same *input*. Such materials are, for the purposes of this standard, classified depending on the *material category* from which they are (co-)produced. *(Pre-consumer reclaimed material)*

Component
An individual and distinguishable part of an assembled product. *(Minor components)*

Controlled material
Virgin material originating in non FSC-certified forests or plantations from *suppliers* included in the verification program of *organizations* certified according to FSC-STD-40-005. *(FSC Controlled Wood)*

Conversion factor
The ratio between material quantity entering and leaving a given transformation process employed by the *organization*. The *conversion factor* is calculated by dividing the *output* (volume or weight) by the *input* (volume or weight) and is applied to each individual *component* of a *product group*.

Credit account
A record kept by a certified *organization* operating a *credit system* which lists entries and withdrawals of volume credits for the purpose of selling products with *FSC claims*.

Credit claim
Part of an *FSC claim* for *FSC Mixed* or *FSC Recycled* products which specifies that the full quantity can be used as *FSC input* or *post-consumer* input for subsequent calculations of *input percentages* or *FSC credit*. Applicable claims are "FSC Mixed Credit" or "FSC Recycled Credit". *(Percentage claim)*

Credit system
A Chain of Custody system applied at the product group level which allows a proportion of *outputs* to be sold with a *credit claim* corresponding to the quantity of *FSC* and *post-consumer inputs*. Considering the applicable *conversion factor(s)*, *FSC* and *post-consumer inputs* can be accumulated as *FSC credit* on a *credit account*. *(Percentage system; Transfer system)*

Eligible input
Virgin and *reclaimed* material *input* that is eligible to enter a specific FSC *product group* depending on its *material category*. *(FSC input; Post-consumer input)*

Material category	Eligible for product group(s)
a) *FSC Pure material:*	*FSC Pure, FSC Mixed*
b) *FSC Mixed material:*	*FSC Mixed*
c) *FSC Recycled material:*	*FSC Mixed, FSC Recycled*
d) *FSC Controlled Wood:*	*FSC Mixed, FSC Controlled Wood*
e) *controlled material:*	*FSC Mixed, FSC Controlled Wood*
f) *post-consumer reclaimed material:*	*FSC Mixed, FSC Recycled*
g) *pre-consumer reclaimed material:*	*FSC Mixed, FSC Recycled*

Finished product
Product that requires no further transformation in terms of processing or packaging prior to its intended end use.

Forestry Conformity Assessment Scheme
A scheme based on the development of standards for forest certification and assessment of operations for trade and production of forest products.

FSC certified material
FSC Pure, FSC Mixed or *FSC Recycled* material that is supplied with an *FSC claim* by an *organization* which has been assessed by an FSC-accredited certification body for conformity with FSC Forest Management and/or Chain of Custody requirements. *(FSC-certified product)*

FSC certified product
FSC certified material that is eligible to carry an FSC label and to be promoted with the FSC trademarks. *(FSC certified material)*

FSC claim
Claim made on invoices for *FSC-certified material* or *FSC Controlled Wood* that specifies the *material category* and, for *FSC Mixed* and *FSC Recycled* products, an *associated percentage claim* or *credit claim*. The appropriate FSC claims for each *product group* and Chain of Custody control system are presented below:

Product groups	Control system	FSC claim
FSC Pure	*Transfer system*	"FSC Pure"
FSC Mixed	*Percentage system*	"FSC Mixed x%"
FSC Mixed	*Credit system*	"FSC Mixed Credit"
FSC Recycled	*Percentage system*	"FSC Recycled x%"
FSC Recycled	*Credit system*	"FSC Recycled Credit"
FSC Controlled Wood	*Transfer system*	"FSC Controlled Wood"

FSC Controlled Wood
Virgin material originating in non FSC-certified forests or plantations supplied with an *FSC claim* by a *supplier* which has been assessed by an FSC-accredited certification body for conformity with FSC Chain of Custody and/or FSC Controlled Wood requirements (FSC-STD-40-005 or FSC-STD-30-010). *(Controlled material)*

FSC credit
Amount of product (volume or weight) that can be sold from a product group with a *credit claim*. Applicable only when using the *credit system*. *(Input percentage)*

FSC input

Input of FSC-certified *virgin material* that counts towards the input percentage or towards the *FSC credit* for a *product group* as follows:

a) material with an *FSC Pure claim*	counts as the full quantity stated on the supplier invoice;
b) material with an *FSC Mixed percentage claim*	counts as the percentage of its quantity that is stated on the supplier invoice;
c) material with an *FSC Mixed credit claim*	counts as the full quantity stated on the supplier invoice;

(Credit system; Eligible input; Percentage system; Post-consumer input)

FSC Pure

FSC-certified *virgin material* originating in FSC-certified forests or plantations that has not been mixed with material of another *material category* throughout the supply chain. *FSC Pure* products are eligible to be used in *FSC Pure* or *FSC Mixed product groups*. *(FSC Mixed, FSC Recycled)*

FSC Mixed

FSC-certified *virgin material* based on *input* from FSC-certified, *controlled* and/or *reclaimed* sources, and supplied with a *percentage claim* or *credit claim*. *FSC Mixed* material is only eligible to be used in *FSC Mixed product groups*. *(FSC Pure, FSC Recycled)*

FSC Recycled

FSC-certified reclaimed material based on exclusive input from reclaimed sources, and supplied with a *percentage claim* or *credit claim*. FSC Recycled material or products are eligible to be used in *FSC Mixed* or *FSC Recycled product groups*. *(FSC Pure, FSC Mixed)*

Input

Raw materials, semi-finished or finished products that are procured or generated by an *organization*, and physically enter the production process or are traded under the scope of a specific FSC product group. *(Eligible input; Output)*

Input percentage

Percentage of *FSC* and/or *post-consumer input* to a *product group* for a specific *claim period.* Applicable only when using the *percentage system*. *(FSC credit)*

Material category

Categories of *virgin* or *reclaimed* material that, if *eligible input*, can be used in FSC *product groups*:

a) *FSC Pure material*
b) *FSC Mixed material*
c) *FSC Recycled material*
d) *FSC Controlled Wood*
e) *controlled material*
f) *post-consumer reclaimed material*
g) *pre-consumer reclaimed material*

Minor components

Forest based *components* of an *FSC Pure* or *FSC Mixed assembled product* constituting less than 5% of the weight or volume of the *virgin* and *reclaimed materials* in the product. Minor components can be exempted from the requirements for Chain of Custody control as specified by this standard.

Non-timber forest product

Material originating in forests or plantations which is not consisting of or derived from wood. *Non-timber forest products* other than cork used in the manufacturing of wood based products (i.e. products which are not classified as *non-timber forest product* according to the FSC *product classification*) are exempt from Chain of Custody control requirements. *(Non-forest based material)*

Non-forest based material

Material that comes from outside a forest matrix. Examples are non-wood plant fibres (e.g. flax used in the manufacture of a board classified as a wood-based panel, or of a composite product), synthesized or inorganic materials (e.g. glass, metal, plastics, fillers, brighteners, etc.), but do not include *non-timber forest products* or *salvaged wood*. *Non-forest based materials* used in FSC *product groups* are exempt from Chain of Custody control requirements. *(Reclaimed material; Virgin material)*

On-product

Term applied to any label, packaging or marking attached or applied to a product. Examples of on-product labels or marks include product tags, stencils, heat brands, information on retail packaging for small loose products (e.g. pencils), protective packaging and plastic wrap.

Organization[8]

Individual, company or other legal entity responsible for the implementation of the standard.

Output

Raw materials, semi-finished or finished products that are produced and/or supplied by an *organization* with an *FSC claim*. *(Eligible input; Input)*

Percentage claim

Part of an *FSC claim* for *FSC Mixed* or *FSC Recycled* products that specifies the *percentage* of their *FSC* or *post-consumer input*, respectively. Buyers of such products must use the *percentage claim* for subsequent calculations of *input percentages* or *FSC credit*. *(Credit claim)*

Percentage system

A Chain of Custody system applied at the product group level which allows all outputs to be sold with a *percentage claim* that corresponds to the proportion of *FSC* and *post-consumer input* over a certain period in time. *(Credit system; Transfer system)*

Post-consumer input

Input of *post-consumer reclaimed* and *FSC Recycled* material that counts towards the *input percentage* or towards the *FSC credit* for a *product group* as follows:

a) *Post-consumer reclaimed material*	counts as the full quantity stated on the supplier invoice;
b) *material with an FSC Recycled percentage claim*	counts as the percentage of its quantity that is stated on the supplier invoice;
c) *material with an FSC Recycled credit claim*	counts as the full quantity stated on the supplier invoice.

(Credit system; Eligible input; FSC input; Percentage system)

Post-consumer reclaimed material

Material that is reclaimed from a consumer or commercial product that has been used for its intended purpose by individuals, households or by commercial, industrial and institutional facilities in their role as end-users of the product. *(FSC Recycled; Pre-consumer reclaimed material; Post-consumer input; Reclaimed material)*

Pre-consumer reclaimed material

Material that is reclaimed from a process of secondary manufacture or further downstream industry, in which the material has not been intentionally produced, is unfit for end use and not capable of being re-used on-site in the same manufacturing process that generated it. *(Co-product; Post-consumer reclaimed material; Primary manufacture; Reclaimed material)*

Primary manufacturing

Any processing that transforms roundwood into materials other than roundwood. For *chip* and *fibre products*, *primary manufacturing* includes the pulp mill as well as the paper mill stage.

[8] In order to remain compatible with ISO definitions, the following terms referring to the supply chain are used: supplier » organization » customer.

Procedure
A specified way to carry out an activity or process. Procedures can be documented or not.

Product classification
The FSC *product classification* is based on the United Nations Statistics Division (UNSD) "Central Product Classification (CPC)" as well as on the related Standard International Trade Classification (SITC). It is made up of a hierarchical system of product classes and associated *product types*. (see "FSC-STD-40-004a: FSC Product classification")

Product group
A product or group of products specified by the *organization*, which share basic *input* and *output* characteristics and thus can be combined for the purpose of FSC Chain of Custody control, percentage calculations and labelling according to the FSC *material categories*: *FSC Pure, FSC Mixed, FSC Recycled* or *FSC Controlled Wood*.

Product type
A general description of *outputs* based on a categorization or classification system. Examples of *product types* according to the FSC *product classification* are: 'logs of coniferous wood', 'wood charcoal', 'chemical wood pulp', 'garden furniture', or 'particle board'.

Promotional
Term applied to all statements, claims, trademarks and such like used to promote pro-ducts, services or *organizations*, but which are not physically attached or applied to a product itself.

Reclaimed material
Material that demonstrably would have otherwise been disposed of as waste or used for energy recovery, but has instead been collected and reclaimed as *input* material, in lieu of *virgin material*, for re-use, recycling, re-milling in a manufacturing process or other commercial application. *Inputs* of the following *material categories* are classified as *reclaimed material*:

a) *FSC Recycled material;*
b) *Post-consumer reclaimed material;*
c) *Pre-consumer reclaimed material.*

(Virgin material)

Salvaged wood
Wood that has been felled for reasons other than obtaining its lumber, or which was felled for its lumber and subsequently lost or abandoned. Examples include lake/river salvage (logs/timber that sank to the bottom of a river or lake while being transported), wood from orchard clearance, wood from road clearance and urban harvested wood. For the purposes of FSC Chain of custody Control and labelling *salvaged wood* is considered as *virgin material* and shall be controlled for use in FSC *product groups*.

Scope
The *scope* of a Chain of Custody certificate defines the *organization's sites*, *product groups*, and activities that are included in the evaluation by an FSC-accredited certification body, together with the certification standard(s) against which these have been audited.

Site
A single functional unit of an *organization* or a combination of units situated at one locality, which is geographically distinct from other units of the same *organization*. One or more sub-sites may be regarded as part of a *site* if they are an extension of the main site with no purchasing, processing or sales functions of their own (e.g. a remote stockholding and despatch site).

Solid wood products
Products that constitute a single, solid piece of wood, such as a log, beam or plank. *(Assembled products; Chip and fibre products)*

Species terminology
The FSC *species terminology* is a compilation of the scientific and common names of tree species used in the international trade, sorted according to their overall category ('conifers' vs. 'deciduous'), genus/species and existing varieties. The hardwood species terminology follows the database compiled by Richter, H.G., and Dallwitz, M.J. (2000 onwards): "Commercial timbers: descriptions, illustrations, identification, and information retrieval. In English, French, German, Portuguese, and Spanish. Version: 16th April 2006" which is available online at http://delta-intkey.com. (see "FSC-STD-40-004b: FSC Species terminology")

Supplier
Individual, company or other legal entity providing goods or services to an *organisation*.

Transfer system
A Chain of Custody system applied at the *product group* level, which allows *outputs to be* sold with an *FSC claim* that is identical to the *material category* and, if applicable, the associated *percentage claim* or credit claim with the lowest *FSC* or *post-consumer input* per input volume.
(Credit system; Percentage system)

Transport documentation
Covers all types of delivery, both international shipping documents and local delivery notes.

Virgin material
Primary (i.e. non-reclaimed) material originating in forests or plantations. *Inputs* of the following *material categories* are classified as *virgin material*:

a) *FSC Pure;*
b) *FSC Mixed;*
c) *FSC Controlled Wood;*
d) *Controlled material.*

(Reclaimed material)

7.2.2 PEFC – Programme for Endorsement of Forest Certification schemes

PEFC is a global umbrella organisation for the assessment, and mutual recognition, of national forest certification schemes that are developed through a multi-stakeholder process. This process, respects the principle of subsidiarity, which means that although national schemes remain independent they co-operate with each other under the PEFC umbrella. This ensures that the wood products emanating from each scheme meet equivalent standards and can therefore be traded internationally. The national schemes build upon the inter-governmental processes for the promotion of sustainable forest management; a series of on-going mechanisms and an outcome of the Rio Earth Summit, which are supported by 149 governments in the world covering 85% of the global forest area.

7.2.2.1 Why choose PEFC Certification?

Currently, with over 196 million hectares certified, PEFC is the largest resource of certified wood from sustainable forest management. Third party audited, to internationally recognised and globally respected certification processes, ensures that PEFC certification provides a transparent system of forest inspection. Chain of custody certification provides a means of tracking fibre from harvested tree to the end product. Specifying PEFC-certified fibre/paper will provide you and your customers with assurances that the paper products originate from legal and sustainable sources.

7.2.2.2 What are the benefits PEFC Certification?

- PEFC allows you to be confident about your raw material sourcing
- PEFC certification provides a fully audited and verifiable supply chain from forest to end use
- PEFC certification provides you and your customers with assurances that the fibre used and the products purchased originate from legal and sustainable sources
- PEFC reduces risk and improves the internal efficiency of your business throughout the paper supply chain accounting system by integrating Chain of Custody certification into your company's quality management and control systems
- PEFC provides a practical demonstration of your company's corporate, environmental and social responsibility by forming the foundation of a credible paper procurement policy
- PEFC gives access to its trademarked logo for both on and off-product communications.

7.2.2.3 PEFC Chain of Custody Certification

Chain of custody is the process by which the source of a forest product is verified. In order for products originating from certified sources to carry the PEFC logo, the certified raw material must be tracked from the forest through the supply chain. Only when this process has been independently verified and the product contains a minimum percentage of 70% PEFC-certified material is the product eligible to bear the PEFC Trademark.

For further information on PEFC Chain of Custody Certification visit the PEFC UK web site - http://www.pefc.co.uk/chain_of_custody.shtml

7.2.2.4 Endorsed Certification systems

PEFC has endorsed certification systems in more than 20 countries on 4 continents.

For further details visit PEFC's international web site: www.pefc.org

7.2.2.5 PEFC labelling standards

Similar as FSC PEFC provides different labelling systems based on a percentage and a credit system.

7.2.3 Characteristics/ differences between FSC and PEFC

- FSC was originally mainly developed by NGOs (Non Governmental Environmental and Human Rights Organisations) whereas PEFC was mainly developed by the European forestry industry, trade organisations and associations of European woodland owners.
- A main principle of the FSC standard is the balance of social, economic and ecological interests, which are represented by a social, economic and ecological chamber both in the international and the national FSC organisations. For main decisions always a consensus of all 3 chambers is needed. Within PEFC the decision making process intends to involve all different interest groups, but a strict balance of interests is not obligatory, which means that decisions can be dominated by one interest group.
- In comparison with PEFC the FSC system is usually more difficult to implement for small forest owners because of higher individual efforts and costs. Within PEFC the certification of total regions is possible, which makes it more convenient for small forest ownership structures as they are present for example in many European countries.
- FSC does per definition not allow the planting of Genetically Modified Trees (GMOs). Within PEFC such limitations do not exist.
- Although FSC certification is also possible for large scale plantations, it is not possible to certify plantations, which have been established by conversion of natural forests after November 1994. Within PEFC plantations are handled differently depending on the national standard. Whereas some PEFC endorsed standards do not offer the certification of plantations at all, others do. Within PEFC there are no uniform restrictions regarding the conversion of natural forests.
- The FSC system is supported by most international NGOs, whereas the PEFC system is not considered as equally stringent and transparent by these NGOs.
- Because the FSC system has been and still is very much promoted by the NGOs, a certain market demand from consumers for FSC certified products has been created in specific areas, which is currently not so much the case for PEFC certified products.
- Regarding the avoidance of controversial sources in products, where also not certified materials are used, PEFC only refers to "Illegally harvested wood" as a controversial source whereas FSC refers to the following 5 different kinds of controversial sources:

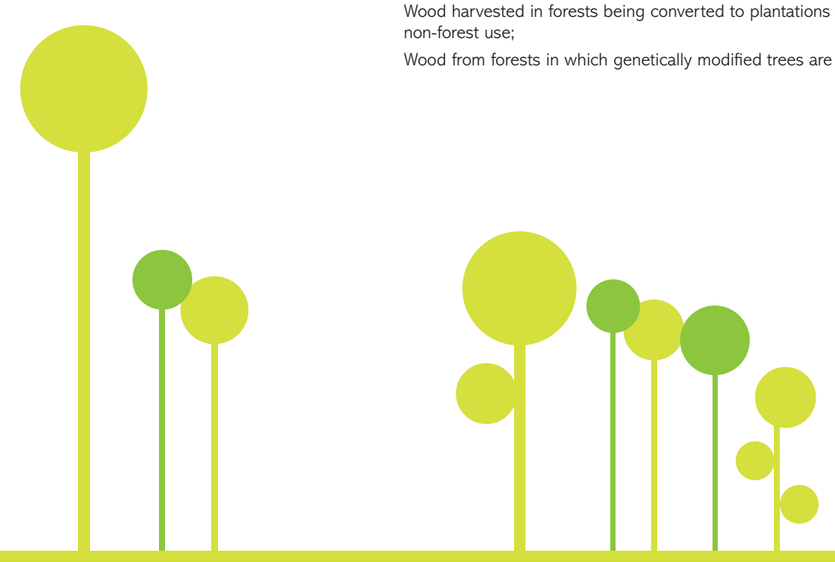
  Illegally harvested wood

  Wood harvested in violation of traditional and civil rights;

  Wood harvested in forests where high conservation values are threatened by management activities;

  Wood harvested in forests being converted to plantations or non-forest use;

  Wood from forests in which genetically modified trees are planted.



7.3 Reporting of relevant forestry information

7.3.1 Certified content

Since forest certification should provide satisfying assurance about sustainable forestry practices usually the content of virgin fibre raw-material coming from certified forests is reported.

7.3.2 Applied certification systems [FSC, PEFC, others]

Since the internationally relevant systems (FSC/PEFC) are often rated differently by many Stakeholders; the proportion of wood coming from the individual systems is stated.

7.3.3 Information about the origin of the non certified content

For the remaining not certified virgin fibre content of the products often the detailed origin (country, region or even the individual forestry units) of the wood is requested in order to allow identification and exclusion of potentially controversial sources. This information is of high relevance, if assurance about sustainable forestry practices is required.

7.3.4 Information about the origin of the certified content

Since forest certification should provide satisfying assurance about sustainable forestry practices already, information about the detailed origin of the certified raw-materials should usually not be necessary, except the credibility of the applied certification systems is questioned or there are other reasons, why the information is needed.

7.3.5 Controlled/traceable content

Together with the definition of controversial sources the FSC and PEFC systems also have defined the necessary measures for operations to avoid such sources within their supply-chain. The systematic verification of relevant supplier's information and documentation to avoid controversial sources can be done either by independent 3rd parties or by a company internal wood verification programme. The proportion of the virgin fibre raw-material, which is not certified but covered by a wood verification programme is reported as controlled or traceable and is relevant, if assurance about at least acceptable forestry practices is required.

7.3.6 Description of control mechanisms

The standards that are applied for wood control/wood tracing in order to exclude controversial sources need to be stated or, if there is a company internal wood verification programme in place, a description of the applied procedures is requested. Important standards and guidelines in this context would be:

1) FSC Controlled Wood Standard.
2) PEFC Standard for avoidance of the procurement of raw-material from controversial sources.
3) WWF GFTN (Global Forest and Trade Network) Responsible Purchasing of Forest Products (Guideline).

7.3.7 Applied labelling system [pure, percentage based, credit based]

For products, which are labelled and traded as FSC certified products, the kind of product, the applied COC system as well as the used material categories are of interest in order to allow the correct declaration of the products on documents and to determine the correct label, if necessary:

- Information, whether it is a FSC Pure, FSC Mixed or FSC Recycled product is needed.
- In the case of FSC Mixed or FSC Recycled products, information is needed whether the product is produced according to the Percentage and Credit system.
- In the case of the Percentage system, information about the actual percentage of certified virgin/recycled fibre in the product is needed.
- In the case of the Credit system no percentage information is needed because within FSC the volume credit is always distributed to the output products in a way that the certified products will be considered as including 100% of certified raw material.
- In the case of a Mixed product, information about the used raw materials (certified fibre, recycled fibre, controlled fibre) is needed, if the correct FSC Mixed label has to be determined.

For products, which are labelled and traded as PEFC certified products, the kind of product and the percentage of certified virgin and recycled fibres is needed:

- In order to determine the correct label information is needed, whether it is a "PEFC certified" product (virgin fibres only) or a "PEFC certified and recycled" product (virgin and recycled fibres used).
- Within PEFC the information, whether the product is produced according to the Percentage or Credit system, is not required for product declaration.
- Regardless, whether the Percentage or Credit system have been used, the percentage of certified virgin/recycled fibre in the product is needed, because in the case of the Credit system within PEFC the volume credit not necessarily is distributed to the output products in a way that the certified products will be considered as including 100 % of certified raw material.

7.3.8 Forest Management Plans

Forest Management Plans can be considered as a basic prerequisite for sustainable forest management practices. For certified forests, Forest Managements Plans have to be in place in any case, which means, that this question should only be applicable for non certified forests.

7.3.9 Genetical Modified Organisms [GMOs] in forestry

Since according to the FSC standard GMOs in forestry are prohibited in any case, the question only is applicable for PEFC certified forests and forests not being already certified. Generally nowadays GMOs are still not commonly used in forestry with the exception of some countries like for example China. Consequently the question might not be relevant in most cases.

7.3.10 Tree species

According to CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), which is an international agreement between governments with the aim to ensure that international trade does not threaten the survival of endangered species, the trade of specific tree species is restricted.

The information about the tree species utilised for pulp and paper production is collected to ensure, that none of these CITES species are included in the wood supply and also can provide valuable information about the risk of potentially controversial sources. Since CITES species however are not commonly used for pulp and paper production in most cases the information is not of highest relevance.

7.3.11 Ownership of the forests of origin

For determination of the risk of potentially controversial wood sources also the ownership of the forests can be of interest and relevance. For paper producers it is usually requested to split the total virgin fibre supply into:

(1) Fibre originating from wood from company owned, leased and managed forests.
(2) Fibre originating from purchased wood from forests owned/leased/managed by third parties.
(3) Purchased fibre (not-integrated paper mills).

8. PAPER RECYCLING (FROM DIFFERENT PERSPECTIVES)

8. PAPER RECYCLING (FROM DIFFERENT PERSPECTIVES)

8.1 Relevant background information

Introduction:

Since the recycling of paper is a prerequisite for a sustainable global fibre cycle and paper market, information about recycling aspects are of highest relevance for many stakeholders. There are numerous general questions regarding the environmental aspects of recycled fibre in comparison with fresh fibre and there is also interest in the origin and quality of the recycled fibre used.

8.1.1 Frequently asked questions (FAQ)

8.1.1.1 What are the environmental impacts of fresh fibre production? What are the relevant differences between fresh fibre production and recycled fibre production in terms of environmental aspects?

Since the paper production process itself is more or less identical for recycled and fresh fibre paper, the main environmental difference is related to the fibre production process. The majority of the utilised fresh fibre nowadays comes from chemical pulp production. Consequently the following chapter refers to the differences between recycled fibre and chemical pulp production from environmental perspective.

In the past because of many reasons fresh fibre production came along with significant negative environmental impacts and regionally often caused unacceptable levels of pollution. Whereas a number of fresh fibre production plants with comparably low environmental performance might still exist today, the majority of the fresh fibre nowadays is produced according to highest environmental standards. If Best Available Technique (BAT) is applied, emissions from fresh fibre production can be minimized to an extent, which normally does not cause a critical environmental impact.

In comparison with fresh fibre production of low environmental performance recycled fibre production only causes a small fraction of the negative environmental impact. However in comparison, if Best Available Technique is applied, the “environmental gap” between fresh and recycled fibre production is significantly smaller. Nevertheless recycled fibre production offers certain environmental advantages, which means that there are still good arguments to further increase the recycling of paper.

Consumption and pollution of water

In the past no effluent treatment plants had been in place and also other important measures to minimize water pollution and consumption within the production process had not been taken. Consequently the rivers, where pulp and paper industries had been located, often were heavily polluted.

Nowadays biological effluent treatment as well as other pollution prevention technologies, such as TCF and ECF bleaching, can be regarded as an international standard within pulp and paper industry and allow to produce much higher quantities of product without compromising the ecological balance of rivers any more.

If Best Available Technique (BAT) is applied to both, water consumption as well as the load of organic and inorganic substances in the effluent are still lower for recycled fibre production.

Emission of hazardous substances

In the past the bleaching of the fibre with chlorine was standard and caused significant emissions of chlorinated organic substances (AOX), among them also very problematic ones, such as Dioxines, which was regarded as a threat for human health and environment.

As a consequence Elemental Chlorine Free (ECF) and Total Chlorine Free (TCF) bleaching technologies have been developed and implemented, which has significantly reduced the emissions of AOX and eliminated the formation of hazardous ones.

The re-bleaching of recycled fibre usually is done with a TCF bleaching process, whereas the majority of fresh fibre is bleached with an ECF process causing however much less emissions of AOX than in the past.

Several studies have confirmed, that the remaining AOX emissions from ECF bleaching according to BAT have a composition similar to those found in nature, degrade naturally and do not persist in the environment and consequently present a negligible environmental risk to aquatic ecosystems.

Nevertheless it should be mentioned, that there is big potential to further reduce the emissions of AOX and avoid the formation of hazardous ones by equipping the few still existing old chlorine bleaching plants with either TCF or ECF technology.

Air emissions

In the past, when energy efficiency was low and the pulping process was still largely dependent on fossil fuels often coal or heavy fuel oil were utilized as the primary energy source. If appropriate air pollution prevention technologies were not in place, the pulping process was a significant source of air pollution.

Due to the fact, that pulp and paper making is a very energy intensive industry, energy efficiency measures have been taken because of environmental and economic reasons. Because of the efficient energetic utilisation of the lignine and bark, fresh fibre production has become largely independent from fossil fuels and modern air pollution prevention technologies allow to reduce air emissions significantly. If BAT is applied, even big pulp production plants nowadays do not represent a problematic source of air pollution.

In comparison to fresh-fibre production, where energy consumption is generally higher and also specific process related emissions occur, recycled fibre production however causes less air emissions.

Energy use

In the past energy efficiency of fresh fibre production was much lower than it is now. In the earlier times of the pulping process the lignine, which gets extracted out of the wood for cellulose production, was not utilized for energy production but released unutilized to the rivers within the effluent, which caused significant pollution. Also the bark often was landfilled instead of being utilised for energy production. Fossil energy and often coal was the primary energy source. Later industry started to utilize the energy content of the bark and the lignine and increased energy efficiency by consistent application of cogeneration and heat-recovery, which finally resulted in a fully energy self-sufficient process, even capable to supply considerable amounts of surplus energy either to integrated paper production or to 3rd parties.

Recycled fibre production plants also can use some by-products/wastes from paper collection (rejects, such as plastics and other combustible wastes) for energy production, however the major part of the energy demand usually must be supplied from the grid.

In comparison to recycled fibre production, fresh fibre production needs significantly more primary energy. However, because of the energetic utilisation of bark and black-liquor for fresh fibre production almost no fossil energy (except for the calcination process in the lime-kiln, for starting-up and as a backup fuel) is necessary, whereas the grid-energy needed for recycled fibre production is often to a large extent based on fossil energy.

GHG Intensity/ Carbon Footprint

Both fresh fibre and recycled fibre production play a particularly important role for the Carbon Footprint of the overall value-chain and it is not really possible to weight one against the other in that respect.

Provided that the processed wood for fresh fibre production is based on sustainable forestry, on a continual base carbon dioxide gets extracted from the atmosphere and gets bound in the wood. A certain part of the carbon stored in the wood is released again, when lignine and bark get utilized for energy production. The other part however gets stored in the product and remains bound as long as the product exists. Both the extensive utilisation of renewable energy during production as well as the fact that carbon, which was extracted from the atmosphere, gets bound in the product, have to be considered as a highly positive impact on the overall Carbon Footprint of the pulp and paper value chain.

If paper at the end of the value-chain gets landfilled, depending on the degradation rate a certain portion of the carbon content remains bound in the landfill another part however is released and also highly climate relevant emissions of Methane are formed.

Consequently also recycled fibre production plays an important role for the overall Carbon Footprint of the value-chain:

- Methane emissions from landfilling of paper are avoided.
- A small portion of the fibre gets lost but is usually at least used for energy production (combustion of fibre sludge from effluent treatment) and does not get landfilled.
- The lifetime of the fibre is prolonged and by that also the carbon storage effect, which was achieved by fresh fibre production.
- Generally a considerably less energy intensive secondary raw-material is generated.

Formation of wastes

The specific inorganic wastes from fresh fibre production, such as dregs, lime mud and ashes usually are not of specific environmental concern. In most cases they get disposed on landfills, but there are also options to re-utilize certain inorganic wastes for production of construction materials, such as bricks or cement. Organic wastes that get disposed on landfills are more problematic because of the formation of Methane during degradation. Consequently in modern pulp mills also sludges from effluent treatment usually get combusted together with the bark or black liquor.

Although paper recycling generally supports the reduction of wastes, during recycled fibre production considerable volumes of wastes are generated, such as rejects, deinking sludge and sludge from effluent treatment. The extent of waste formation mainly depends on the quality of the recovered paper used and the required quality of the recycled fibre. By combustion of these wastes for energetic utilization their landfilling can be avoided.

Waste reduction

In the past the increasing volumes of wastes (among them the waste paper) caused significant concern. Waste paper was primarily collected and recovered within industry but not systematically in the private households.

Nowadays the recovery of all kinds of recyclable wastes (not only paper) out of the waste streams has become the standard and a legal obligation in many developed countries. However, also in countries where no respective legal obligation exists, waste paper is collected since it is also economically feasible to make it available as a secondary raw-material to industry. With an utilisation rate of 46 % in the worldwide average, recovered paper has become a similar important raw-material for paper production as wood based fresh-fibre.

By paper recycling the from environmental perspective worst option of landfilling of the paper together with other wastes, which is associated with negative impacts to water, air and the climate, becomes avoided. The energetic utilisation of paper (e.g.: combustion in waste incineration plants) is certainly better than the landfilling, but usually cannot provide the same environmental benefit as paper recycling.

Deforestation

Since wood is the primary raw-material for fresh fibre production, pulp and paper industry commonly is considered to contribute to deforestation by unsustainable exploitation of the world's forests.

However ensuring the supply with its primary raw-material wood is of fundamental interest for the industry and consequently two main steps were taken not only because of ecological but also substantial economic reasons:

In many regions land area has been and still is being converted to fast growing tree plantations in order to generate high quality wood for the industry but also to reduce the pressure on natural forests in the long term.

On the other hand much effort was taken to implement and verify sustainable forestry practices. Since the early 1990s, when with the Forest Stewardship Council (FSC) the first international forest certification standard was developed, pulp and paper industry step by step followed the concept of forest certification and can be seen nowadays as one of the major users and supporters of this concept.

Nowadays 16 % of the harvested round-wood and in total 18 % of the total wood flow is consumed by pulp and paper industry. Today usually not the utilisation of wood is the main driver for deforestation, but the conversion of forest area into agricultural land for feed and food production.

In the contrary, nowadays the majority of the paper products worldwide are sourced from sustainable forestry and by that promote/legitimate and actively maintain forested land.

Because the overall majority of the fresh fibre is sourced from managed forests and plantations, which are continually reforested after harvesting, the recycling of paper usually will not "save forests" from deforestation, however it ensures that the renewable raw-material wood gets utilized efficiently.

Depletion of our resources

If fresh fibre production is based on not sustainable forestry practices and results in a loss or degradation of forests, it is certainly a contributor to resource depletion.

If however sustainable forestry is ensured, fresh fibre production creates a renewable raw-material of highest quality and additionally provides renewable surplus energy out of sustainably managed forests.

Recycled fibre production re-creates a highly valuable raw-material out of the waste stream and by that avoids negative environmental impacts associated with landfilling.

Both recycled fibre as well as fresh-fibre production based on wood from sustainably managed forests provide renewable raw-material for multiple purposes and also other values and can be seen positive from point of view of resource depletion.

Increased recycling but also the increased sustainable utilisation of the available renewable resources (fresh and recycled fibre) are important potentials to further improve our overall footprint, since other non-renewable resources can be substituted.

8.1.1.2 What are the socio-economic impacts of fresh-fibre in comparison with recycled fibre production ?

Fresh and recycled fibre production in principle come along with similar socio-economic benefits, however there are differences in terms, where these benefits can be achieved.

Economic value out of a natural and renewable resource

By fresh fibre and recycled fibre production economic value can be generated out of a natural and renewable resource.

Since wood is the base for fresh fibre production especially rural areas, where otherwise economic benefit would be difficult to generate, can gain substantial benefit out of it.

Economic value out of recycled fibre production in comparison is more located in urban areas, where the majority of the waste paper is generated and recovered.

Social value out of a natural and renewable resource

In regions having big forest resources fresh fibre production can also add a significant social value. Sustainable forestry management, wood harvesting, wood transport and pulp production create employment in a rural and in terms of employment usually problematic environment.

Since pulp production plants are complex facilities also considerable induced employment is created.

But also the recycling of paper represents an important opportunity to create employment by the collection and separation of recovered paper and its transformation into recycled fibre.

Socio-economic and environmental synergies

Fresh fibre pulp production plants nowadays usually have to be equipped with efficient effluent treatment plants of high capacity, which can easily and in many cases actually do also treat the effluent of the surrounding community. By that high costs (for separate plants) for the communities can be reduced and in some cases, where no effluent treatment is standard but high emissions are in place, the environmental situation can even be improved.

Similarly synergies can be achieved by the provision of grid energy (both electricity and steam) from the highly efficient power plants (cogeneration) of pulp mills to the community.

Furthermore significant synergies with other forestry products industries must be mentioned, meaning that wood utilisation in general becomes more feasible, if all wood qualities as well as by-products can be utilised materially.

For recycled fibre production the most obvious synergy is the transformation of an environmental and economic burden (landfilling of organic wastes) into a highly potential renewable raw-material.

Supply of a natural and renewable resource

Fresh- and recycling fibre production create an from overall perspective highly valuable "renewable" raw-material (the cellulose), which can not only be used for all kinds of different paper, packaging, medical and hygienic products, but also for products like insulation and construction materials as well as textiles.

Potential negative socio-economic impacts

It should however be mentioned, that also negative socio-economic impacts can come along with fresh fibre production, if for example large scale tree plantations are created without considering the specific local circumstances. Land, which gets converted to plantations, or forests, which are logged, sometimes are used by local communities for different purposes, such as hunting, farming or as pasture for cattle. Also potential negative environmental impacts from plantations as well as emissions from pulp mills, if they are not minimized to an acceptable level by responsible management, can cause negative socio-economic impacts for the affected communities.

In comparison risks of negative socio-economic impacts from recycled fibre production are certainly lower.

8.1.1.3 What are the limits of paper recycling?

Limits in terms of quality

Cellulose fibres cannot be recycled indefinitely. Most sources state, that fibres can be recycled up to 4-6 times, because afterwards relevant quality parameters of the fibre, such as the fibre-length and its vitality (stiffness/robustness), are degraded to an extent, which does not allow a reasonable reutilisation for paper products any more.

Also it is important to understand, that not all recycled fibres are similar suitable for all kinds of fibre products.

(1) Mechanical properties (strength/length/stiffness)

During fibre and paper production, the fibres get highly exposed to mechanical and thermal stress. (deformations of the fibre, drying)

Consequently they become shorter, thinner and weaker with every recycling cycle and cannot be recycled indefinitely mostly because of that reason.

(2) Optical properties (whiteness/brightness)

If printed paper products get recycled, the fibre is heavily contaminated with all kind of substances (ink, tints, toner, dirt), which would not allow to produce products with high optical quality demands.

In order to recycle such contaminated fibre for bright fibre products, the contaminants have to be removed, which is done during the so called "Deinking Process".

But also fibres, which have been deinked with highest efforts and which afterwards additionally get re-bleached will hardly achieve the same optical quality properties again as fresh fibres have after primary bleaching.

(3) Hygienic properties

In the drying section of the paper machines, paper usually gets heated to an extent, which naturally will sanitize the majority of potentially harmful germs, which to a certain extent can be contained in contaminated recovered paper. Compared to fresh fibre, where germs because of the origin of the raw-material and also because of the chemical conditions during the pulping process can be excluded, the likelihood of remaining germs in recycled fibre is certainly higher.

Consequently for the production of specific hygienic and medical tissue products fresh fibre should be the preferred raw-material.

Packaging materials for food contact for example in principle can be produced from recycled fibre, however there are restrictions regarding the kinds of recovered paper, which can be used. Also, if recycled fibre is used for such products, a much higher effort for ensuring of the hygienic minimum standards is necessary in comparison to fresh fibre.

(4) Durability properties

Paper, that is for example used for specific archiving purposes or because of other reasons has to be highly durable/stable, preferably should be produced from fresh fibre (chemical pulp), since within recycled fibre most probably also mechanical pulp is contained, which causes a lower durability of the paper.

Limits in terms of availability

In order to understand the actual remaining potential for increasing of fibre recycling, the volumes of non collectable/non recyclable paper products have to be determined, such as

- Long lasting products (archiving materials and books), but also some packaging materials.

  Even though they come back to the flow later on, it is necessary to take them into account, as they cannot be collected / recycled in the year they have been put on the market.
- Packaging materials, which get contaminated during their utilisation to an extent that does not allow further recycling
- Tissue products, which usually get utilized in a way that does not allow recycling (such as toilet paper).

According to the outcome of the study on "Non-collectable and non-recyclable paper production" sponsored by CEPI on average 19 % of total paper and board consumption is considered to be non-collectable and non-recyclable in Europe for technical reasons. Consequently the remaining 81 % of fibre products can be considered as the theoretical potential for paper recovery and recycling.

Since collection rates for recovered paper of more than 70 % have already been achieved in several European countries, it seems to be realistic, that a collection rate close to the theoretical limit of about 81 % is in principle possible. However, the more the actual collection rate approaches this theoretical limit, the higher will be the efforts to further increase collection and the lower will be the benefit.

Considering that the worldwide average collection rate is currently about 46 %, it seems, that there is still a big potential to increase paper recycling.

Limits in terms of "environmental efficiency"

From environmental perspective it can be inefficient to use recovered paper of lower quality for highest quality products as long as there is no oversupply of recovered paper and there is still enough potential to increase recycled fibre utilization in lower quality products.

Recycled fibre would replace fresh fibre in high quality products, but at the same time instead of recycled fibre (not being available for lower quality products) more fresh fibre would be utilized in the lower quality products, which is not meaningful because of the following reasons:

(1) Unnecessary/inefficient upgrading of recycled fibre

Usually additional efforts (chemicals, energy) are necessary to upgrade the recycled fibre for its utilisation in highest quality products. As long as there is enough demand for all available recycled fibre for products, where such additional efforts are not required, recycled fibre should preferably be used for these products.

(2) Losses during recycling

For highest quality products usually higher quality demands in the recycled fibre are present.

Consequently if recovered paper of low quality is utilised for higher quality products more fibres have to be rejected and separated from the fibre cycle, which means, that in total more fibre losses will occur in comparison with the scenario, where fresh fibre or highest quality recovered paper is used for the higher quality products and the low quality recovered paper is used for products with lower quality demands.

It means that as long as the available recycled fibre can be utilized in lower quality products, there is no need to promote and increase its utilisation in higher quality products.

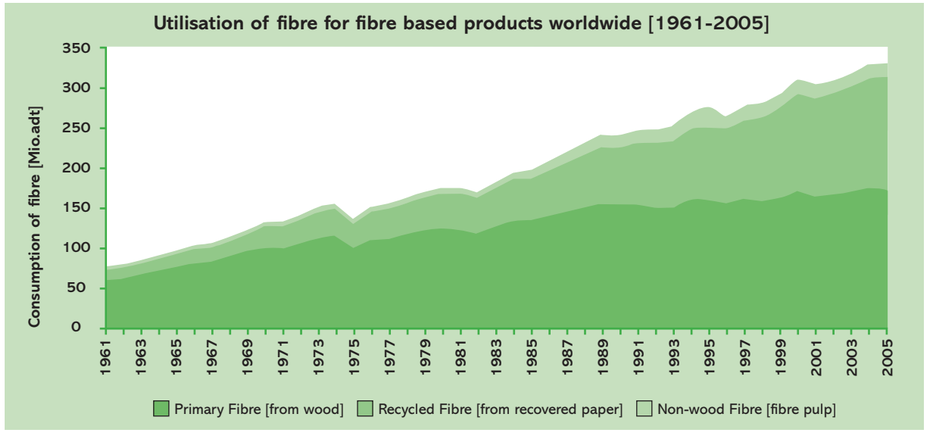
Limits in terms of "economic efficiency"

As long as recycled fibre is less expensive than fresh fibre and can fulfil the quality demands in the product, naturally recycled fibre will be the preferred raw-material and primarily be used for production.

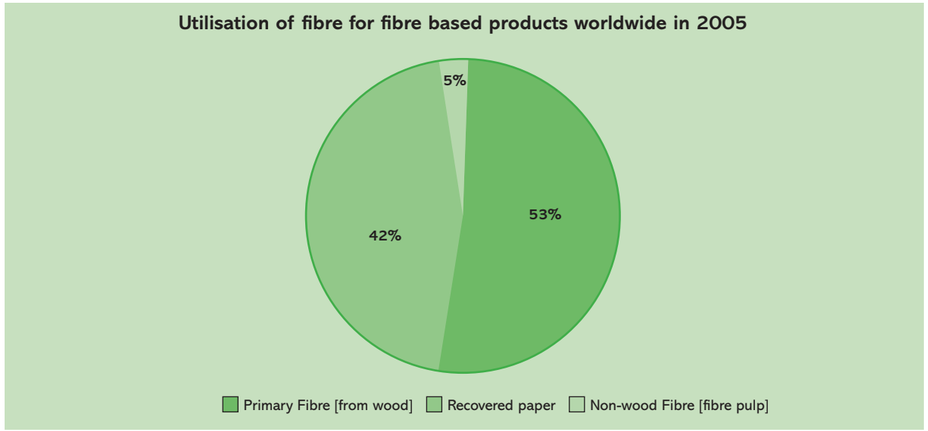
For products with comparably lower quality demands consequently recycled fibre is the primary raw-material, because usually little effort will be necessary to extract fibre of appropriate quality out of the recovered paper and consequently also costs will be low.

For products with high quality demands however, costs for appropriate recycled fibre often reach and even exceed the costs of fresh fibre, which is in addition commonly easier available than highest quality recycled fibre. Consequently the utilization of recycled fibre for certain products can be unattractive from economic perspective, except customers are willing to pay a premium for such products.

8.1.1.4 What is the current utilisation of recycled fibre for fibre based products worldwide?



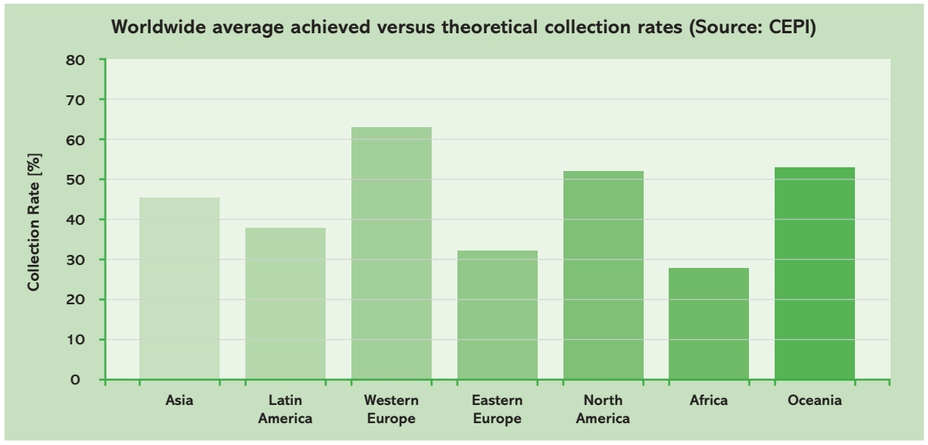
Source: FAO, compiled: sdguide.org



Source: FAO, compiled: sdguide.org

The statistical figures above show that in 2005 in the average 53% of fresh wood fibres, 42% of recycled fibres and 5% of fresh non-wood fibres were used for production of fibre-based products. (The figures are based on the assumption that the average recycled fibre yield from recovered paper is about 85%.)

8.1.1.5 What is the theoretically achievable collection/recycling rate for recovered fibre?

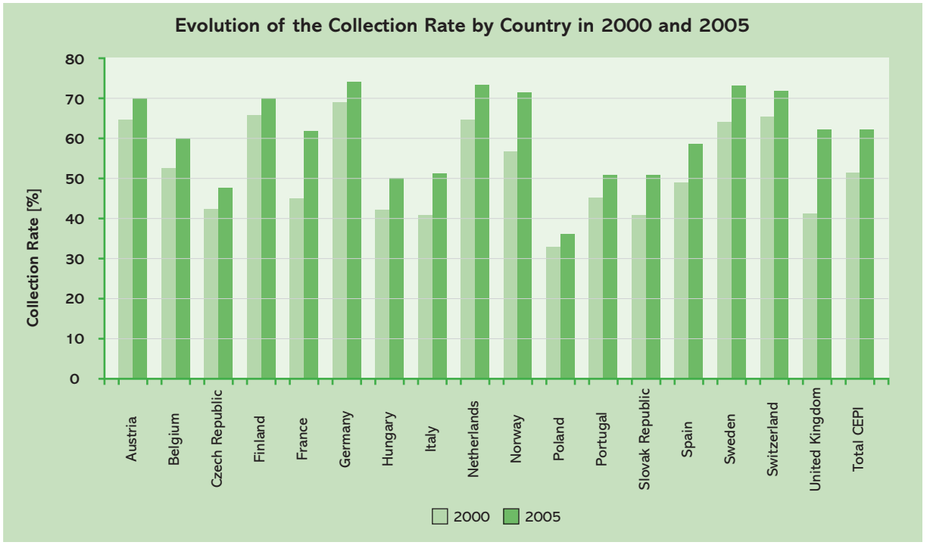


Source: CEPI

The currently worldwide achieved average collection rate for recovered paper of about 46% means that globally the fibre is reutilised only 1.8 times in the average, where many fibres are of course being used several times, but at the same time many fibres are "wasted" already after one utilisation.

Considering that the amount of "non-collectable and non-recyclable paper products" is estimated with 19% the theoretical maximum collection rate would be 81%. This means, that a significant potential for increasing of recycling is still present provided that the necessary volumes of recovered paper can be made available.

8.1.1.6 Where are the highest collection/recycling rates achieved nowadays and who are the benchmark leaders?

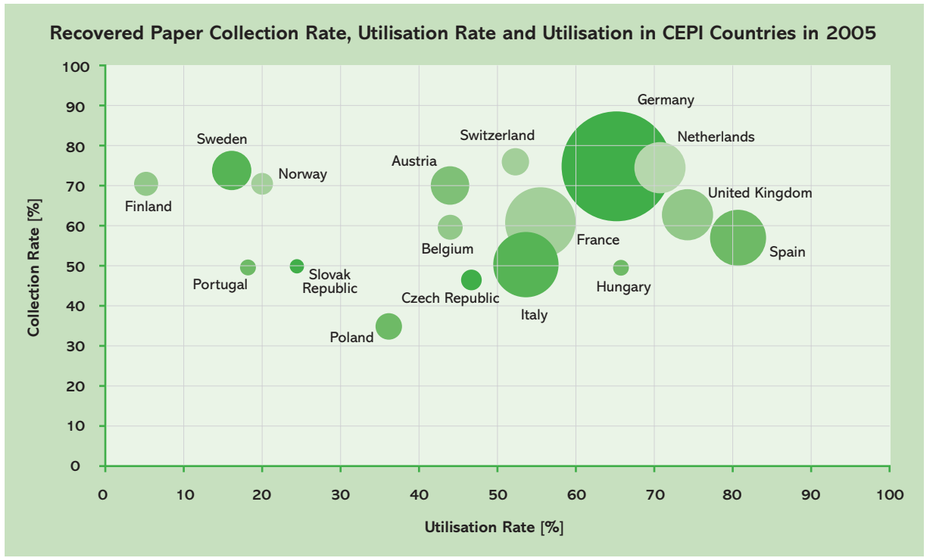


Source: CEPI

In comparison of the global geographical regions currently Western Europe achieves the highest collection rate of about 62%.

When comparing the achieved collection rates in different European countries, it is visible that in some countries collection rates of about 70% have already been achieved (such as Germany, Netherlands, Switzerland, Austria, Sweden, Finland and Norway) whereas in other countries the collection rate is still significantly lower (e.g.: Poland: 35%).

8.1.1.7 What are the current utilisation rates for recovered paper in European countries?



Source: CEPI - Key Statistics 2006

A high collection rate for recovered paper does not necessarily mean also a high utilisation rate in individual countries, which can be explained by the following examples:

Countries like Finland, Sweden and Norway, which have big forest resources and a strong fresh fibre based pulp and paper industry produce much more paper than they consume (net-exporters of paper). Such countries will achieve comparably lower recovered paper utilisation rates although the collection rates are very high.

For countries like Germany and the Netherlands, where paper production and paper consumption are approximately of the same magnitude, also the collection and utilisation rate will be on a similar level.

A low collection rate and a high utilisation rate would for example also be possible, if the collection of waste paper is low, but utilisation of imported waste paper for production is high.

8.1.1.8 Which qualities of recovered paper can be differentiated?

Almost all recovered paper in principle can be recycled, but not all grades of recovered paper are similar suitable for the production of specific products. Depending on the kind and the quality of the paper products but also on the available technology to process the recovered paper only specific grades of recovered paper come into consideration. Consequently the differentiation and standardization of specific qualities of recovered paper is important to allow an efficient and selective utilization.

In Europe different grades of recovered paper are defined in the European list of standard grades of Recovered Paper and Board (European Norm EN 643), which divides recovered paper into 5 groups: ordinary grades, medium grades, high grades, kraft grades and special grades. Each of these groups has a number of subgroups, which specify the recovered paper grade at a detailed level.

http://www.paperonline.org/pdf/EN643.pdf

In the US different grades of recovered paper have been defined by the Institute of Scrap Recycling Industries (ISRI), which currently distinguishes 51 main grades and 35 specialty grades.

http://www.isri.org/AM/Template.cfm?Section=Home1&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=17443

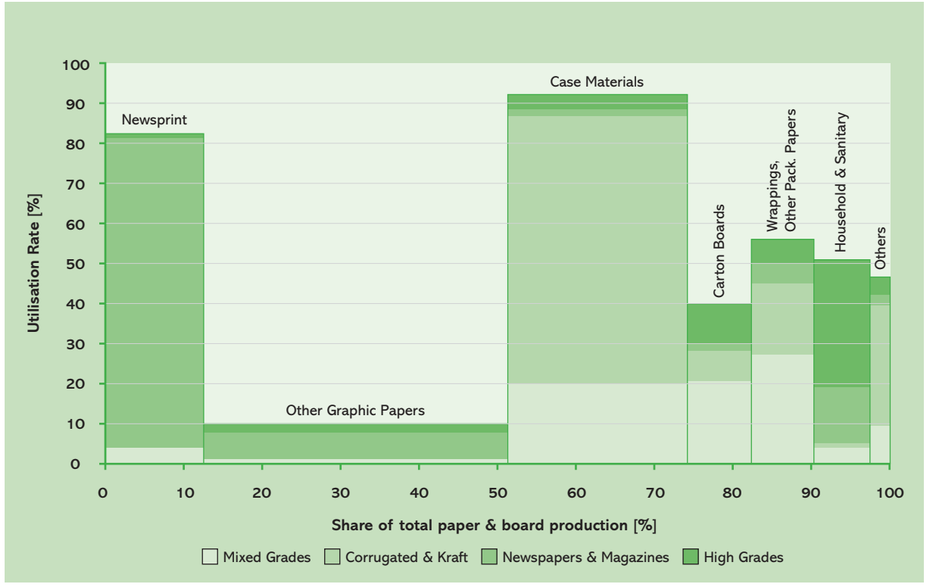
Besides the detailed definition of recovered paper grades according to these standards commonly the differentiation between Post-consumer and Pre-consumer recycled materials is made, which are defined according to ISO 14021:1999 as follows:

Pre-consumer materials are diverted from the waste stream during a manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it (mill-broke).

Post-consumer materials are generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.

Mill-broke refers to any paper or paperboard scrap generated in a mill prior to completion of the manufacturing process which is unsuitable for subsequent applications but can be re-used in the paper manufacturing process. Mill-broke from virgin fibre consequently is not counted as a recycled material.

8.1.1.9 For which paper products the recovered paper gets utilized in Europe?



Source: CEPI - Key Statistics 2006

The above diagram illustrates the utilisation of different grades of recovered paper in the different paper grades within Europe (CEPI countries):

Newsprint

Newsprint, which represents 11% of the Total Paper & Board Production is in the average produced from 81% of recycled fibre and only 19% of fresh fibre. The majority of the recovered paper, which is used for production of Newsprint, is sourced from newspapers and magazines. The explanation for the high percentage of recycled fibre is, that it easily can fulfil the quality demands of newsprint paper.

Other graphic paper (than newsprint)

Other graphic papers than newsprint represent about 38% of the Total Paper & Board Production. The utilisation rate of recycled fibre in this category is only 10%, of which 7% are sourced from recovered Newsprint and Magazines and 3% from High Grades. The explanation for the low percentage of recycled fibre is, that the quality demands cannot easily be fulfilled and efforts and costs are comparably higher.

Packaging materials

Packaging materials (Case materials, Carton Boards, Wrappings and other Packaging Papers) represent about 40% of the Total Paper & Board Production. The average utilisation rate of recovered paper for these products is about 74%. The majority of the recycled fibre in this category is sourced from Corrugated and Kraft and Mixed Grades, but as we can see also Newspapers and Magazines and even High Grades are being utilised, not to forget the 26% of fresh-fibre. The high percentage of recycled fibre again can be explained, that they comparably easily can fulfil the quality demands of many packaging grades.

Household and Sanitary Products (tissue products)

For production of Household and Sanitary products, which represent about 7% of the Total Paper & Board Production, the utilisation rate is 51%, of which the majority is sourced from High Grades.

Conclusions:

Out of the current utilisation of recovered paper/recycled fibre for paper products as shown in the above diagram it is possible to draw the following conclusions:

The preferred paper grades for utilisation of recovered paper/recycled fibre are newsprint, packaging grades and tissue products.

More or less all available Mixed recycling grades as well as Corrugated and Kraft recycling grades are predominantly used for production of packaging materials.

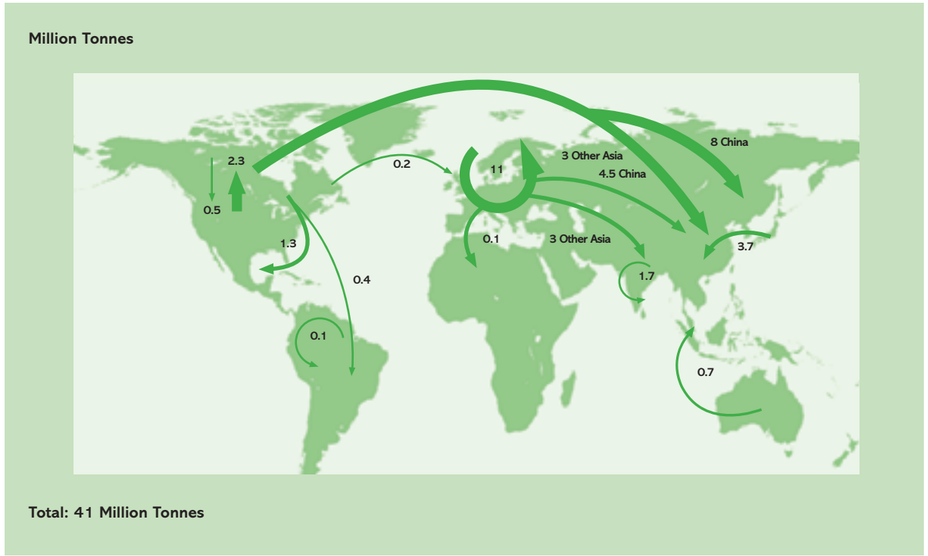
In addition to the Mixed and Corrugated and Kraft recycling grades also most of the available High recycling grades are being used for production of packaging materials and tissue products.

On the one hand it seems, that (compared to all the other paper grades) within the “Other Graphic Paper grades”, there is the highest potential to increase the utilisation of recovered fibre because of the currently low utilisation rate of 10%.

However, on the other hand there is a good reason why recycling fibre is predominantly used for newsprint and packaging products: Because of the lower quality demands for these products (especially in terms of brightness) the utilisation of recycled fibre is possible with much less effort and fibre losses than for graphic paper products with usually much higher brightness demands.

As long as all the available recovered paper can be utilized for paper grades with lower quality requirements, it does not make too much sense to use it for paper grades with higher quality requirements, since efforts and costs for the necessary reconditioning of the recycled fibre are higher.

8.1.1.10 How do the major global trade flows of recovered paper look like?



Source: CEPI/Poeyry

The picture illustrates the major global trade flows of recovered paper. Especially in Asia (China) there is because of a rapidly increasing lack of resources a big demand in recovered paper, which gets imported mainly from the US and Europe.

Europe currently imports 0,2 Mio. tons of recovered paper from the US and in total exports 7,6 Mio. tons, of which 7,5 Mio. tons go to Asia. Imports and exports of recovered paper within Europe make almost 11 Mio tons.

Conclusion:

Recovered paper/Recycled fibre has become a similar important raw-material for pulp and paper industry as fresh fibre from wood.

Usually no recovered paper is wasted (not utilized as a secondary raw-material for fibre production). If the collection of recovered paper becomes higher than its demand in individual regions, the surplus volumes get exported to those regions, where there is a big demand in recycled fibre.

8.1.1.11 What are the definitions of the most relevant recycling terms?

Apparent collection means utilisation plus exports minus imports of recovered paper.

Collection rate means percentage of apparent collection compared to the total paper consumption.

Recovered Paper Utilisation means use of recovered paper as raw material to produce new products.

Recycling rate means percentage of recovered paper utilisation compared to the total paper consumption.

Utilisation by sector means total use of recovered paper in a sector as a percentage of the overall recovered paper use.

Utilisation rate means percentage of recovered paper utilisation compared to the total paper production.

8.1.2 Relevant conclusions

8.1.2.1 Is recycled or fresh-fibre paper more environmentally friendly?

When comparing the different environmental impacts of fresh fibre and recycled fibre production, it becomes clear, that recycled fibre production has environmental advantages in comparison to fresh fibre production regarding a number of environmental aspects and consequently eco-balances usually show a significant environmental advantage for recycled fibre.

It should however be mentioned, that most eco-balances do not consider the different value-creation when comparing fresh-fibre production (fibre of highest quality with 4-6 remaining “lives” is created) and recycled fibre production (fibre of limited quality and less remaining “lives” is recovered).

It is important to realize, that especially because of the limits of paper recycling and the limited availability of recycled fibre fresh fibre and recycled fibre cannot and should not be seen isolated. A continual input of fresh fibre into the global fibre cycle is and will always be needed. Without the continual input of fresh fibre also no recycled fibre would exist in the very short term.

It is also important to consider, that it is not necessarily meaningful to use recycled fibre to the same extent for all different kinds of products. Generally recycled fibres should preferably be used for those products, where they best can meet the respective quality demands. As long as all recovered paper can be used for production of products with lower quality demands, it will be inefficient to use (low quality) recovered paper for production of high quality products.

Generally the cascaded utilisation of our resources has to be regarded as a pre-requisite for sustainable development. In terms of fibre utilization this means that as a matter of principle the highest quality raw-materials should always be utilised for those products having the highest quality demands and achieving the highest actual recovery rates.

Examples:

If a product for example is not recoverable or recyclable and also has comparably low quality demands, the utilisation of recycling fibre, which just fulfils this demand would be the best option. (e.g.: toilet paper)

Here the fibre gets lost after one utilisation and it makes sense to “release” already degraded fibre out of the fibre cycle with such products, if no relevant disadvantages during production and product use are present.

If a product for example is recyclable and achieves comparably high recovery rates and also has higher quality demands, the utilisation of fresh fibre or recovered paper of high quality would be the best options. (e.g.: high brightness graphic paper). Here the product gets most probably recovered and the value of the fibre is utilised most efficiently.

Consequently the question, whether recycled or fresh fibre paper is more environmentally friendly, is not the most relevant one. Much more relevant questions would be, for example:

(1) What are the bottlenecks for increasing of paper recycling?

(2) How can the recycling of paper most efficiently be increased?

8.1.2.2 What are the bottlenecks for increasing of paper recycling?

Recovered paper has become a similar important raw-material for paper production as wood and usually all available recovered paper is utilized by industry as a secondary raw-material as long as the quality demands in the products can be met and costs for recycled fibre do not exceed the costs of fresh fibre. For certain products however an increase of recovered paper utilization is only possible if more recovered paper of appropriate quality becomes available. Consequently the main bottleneck to increase recycling actually is the availability of more recovered paper of appropriate quality.

To a certain extent also the expectation of the consumer in the quality of the products as well as the willingness to pay a premium for specific recycled products will influence the potentials to further increase recycling. For example not for all uses graphic paper of highest brightness and purity is necessary. If for certain uses products with lower brightness and purity are accepted, more recycled fibre can be utilized. On the other hand consumers have to accept that, if highest brightness and purity demands should be met by recycled fibre products, the costs will in many cases exceed the costs of fresh fibre products of similar quality.

Of course also the recyclability of products is an important aspect. In this context for example the design of products can limit the separation of recyclable components, also specific printing technologies cause problems regarding the deinking of the fibre.

8.1.2.3 How can paper recycling most efficiently be increased?

Generally a balanced combination of measures by all involved stakeholders is necessary to efficiently increase paper recycling.

If for example primarily the utilization of recycled fibre for specific products is promoted there is the risk, that although more recycled fibre will be utilized for these products recycling in total will not increase and more a suboptimisation than an overall improvement of the value-chain is achieved.

Considering that the availability of recovered paper of appropriate quality is the main bottleneck, besides promotion of recycled fibre products initiatives are needed, which on the one hand further promote waste separation and collection but at the same time also allow to maintain or even increase the quality of the recovered paper.

Therefore on the side of paper recovery, which is primarily influenced by the authorities, the communities and the industry responsible for waste collection, relevant potentials for improvement would be

(1) To make recovering/recycling of secondary raw-materials more attractive for the end-consumer, e.g. by rewarding good practice and/or at least charging the costs for bad practice

(2) To implement collection systems, which allow to maintain a high quality of the recovered paper (avoid co-mingled collection, where paper gets contaminated leading to deteriorated quality often unsuitable for efficient recycling)

(3) To separate and collect secondary raw-materials organized and efficiently at those places, where big volumes are available (big cities)

(4) To separate if economically and practically feasible (more) different quality grades of recovered paper in order to allow the most efficient recycling possible

(5) To promote recycling in society as a valuable and active contribution for environmental protection

On the paper production side the industry is responsible

(1) To increase recycled fibre production capacities in order to allow the utilization of all recovered paper

(2) To ensure the recyclability of paper products

Also during processing of paper products the industry has to ensure, that the final products are actually recyclable, for example by appropriate product design, which allows an easy separation of recyclable components, and the utilisation of printing technologies, which allow an efficient deinking.

Last but not least on the side of the consumers it is important

(1) To review whether the quality (e.g. brightness) of the used paper is in proportion to the actual product use and whether the same benefit could be achieved also by a recycled product

(2) To separate and collect products after use in order to enable the recycling

Is it acceptable from environmental perspective to use fresh fibre graphic paper instead of recycled paper, if I am not satisfied with the printing results or other disadvantages are present?

Generally fresh and recycling fibres should be used, where they best can meet the product specific quality demands.

If we talk about products with high quality demands and high actual recovery rates, the utilisation of fresh fibre is absolutely acceptable, provided that the wood comes from sustainable forest management, which can be supported and verified by forest certification, and the fresh fibre production is done according to Best Available Technique, which can for example be verified assessing the environmental key performance parameters. A continual flow of fresh fibre into the global fibre cycle is necessary in any case and should occur through products with the highest quality demands and recovery rates.

8.1.2.4 How can an organisation most effectively contribute to an improvement of the overall environmental footprint of the paper value-chain?

(1) Where recycled fibre products can fulfil the quality demands by 100 % and are available to an acceptable price in the required quantity they should be the preferred choice.

(2) Where recycled fibre products cannot fulfil the quality demands by 100 % or are not available to an acceptable price fresh fibre products should be used, which come from sustainable forest management and are produced according to Best Available Technique.

(3) If there are paper uses with different quality demand (e.g. internal and external communication) also different paper qualities should be sourced and utilized, which just fulfil the specific demands.

(4) However, of at least similar importance is to promote and support the increased collection of waste paper within the organisation but also in private households by providing relevant information (education) to its employees, as well as promoting sustainable forestry and forest certification and making employees and end-consumers more aware about certified products.

8.2 Reporting of relevant recycling information

8.2.1.1 Recycled content

The proportion of recycled fibre from the total fibre input certainly has highest relevance in terms of reporting.

8.2.1.2 Post-consumer and pre-consumer content

Besides the total content of recycled fibre also the content of post-consumer and pre-consumer fibre is of interest for many customers.

8.2.1.4 Recycled content of defined EU grades

For certain purposes (e.g. documentation of compliance with Ecolabel standards) the content of individual paper qualities according to the European Standards List of Paper Grades can be of relevance.

8.2.1.5 Mill broke content

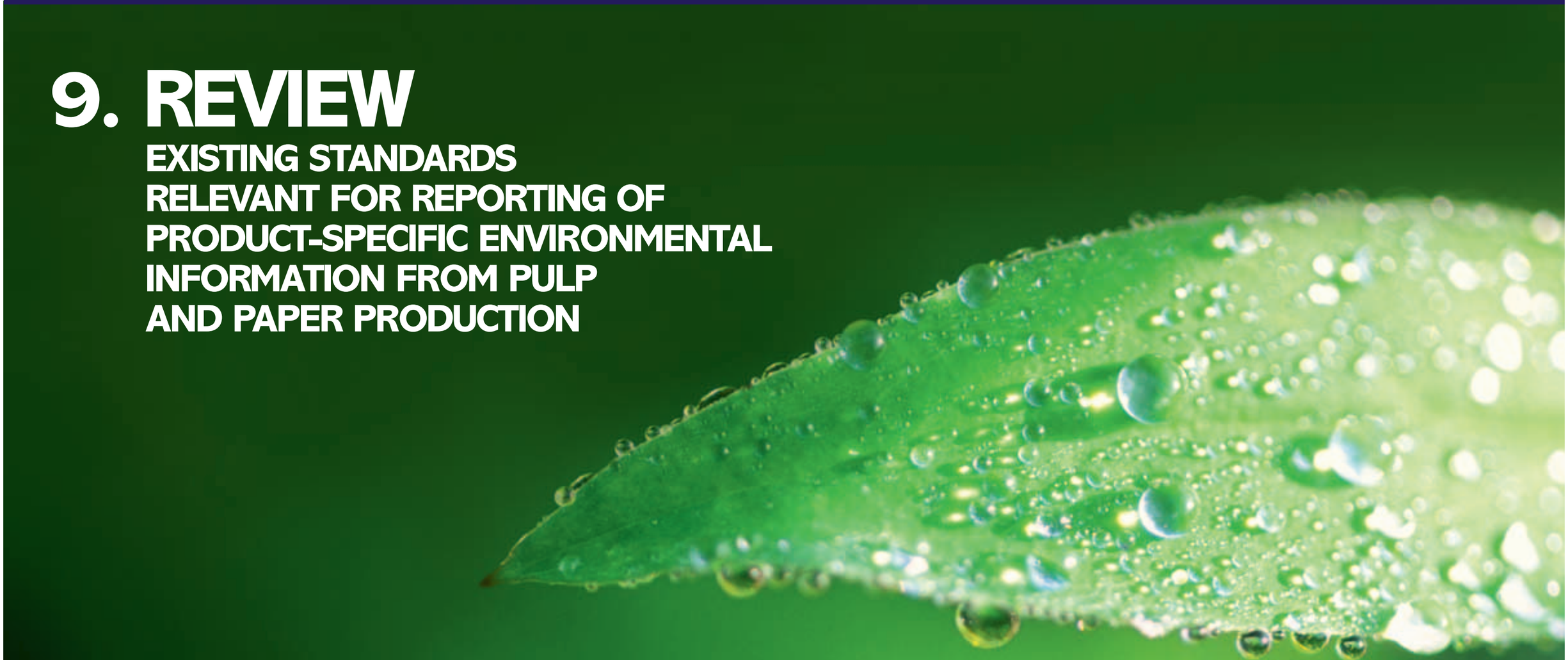
The content of mill-broke (from fresh fibre) utilised for paper production usually is not regarded as relevant for environmental reporting, since mill-broke is not counted as a recycled material.

8.2.1.5 Non wood-fibre content

Besides virgin wood fibre and recycled fibre also the content of non-wood fibre (e.g. from agricultural origin) should be reported.

9. REVIEW

EXISTING STANDARDS RELEVANT FOR REPORTING OF PRODUCT-SPECIFIC ENVIRONMENTAL INFORMATION FROM PULP AND PAPER PRODUCTION



9. REVIEW EXISTING STANDARDS RELEVANT FOR REPORTING OF PRODUCT-SPECIFIC ENVIRONMENTAL INFORMATION FROM PULP AND PAPER PRODUCTION

The following chapter should provide an overview of the relevant standards in terms of collection and rating of product specific environmental key performance indicators and other relevant environmental information for paper products.

9.1 Paper Profile

Background:

- Origin: Leading European paper producers
- Sponsors: Leading European paper producers
- First Launch/Last Update: 2002/2008
- Used: mainly in Europe by relevant paper producers and merchants
- Further information: **www.paperprofile.com**

Main functionalities:

- Standardised environmental data collection sheet for paper products

Characteristics:

- Compact data sheet providing a selection of the most important key performance indicators related to pulp and paper production
- Broad acceptance on the European paper markets
- No support for the interpretation of the data is included.
- The utilisation of Paper Profile requires membership, but is free of charge.
- Currently it is kept flexible (up to the user of the Paper Profile), whether the reported information is verified by independent 3rd parties or not

9.2 EPAT

Background:

- Origin: Paper Working Group (PWG) – a collaborative project of Metafore and 11 leading companies, USA
- Sponsors: Forest Association of Canada (FPAC) & PWG
- First Launch/Last Update: 2006 (Version 1.0) / 2007 (Version 2.0)
- Used: nowadays mainly in the USA
- Further information: **www.epat.org**

Main functionalities:

- Standardised environmental data collection for paper products
- Comparison with industry averages to determine relative performance
- Allows an individual weighting and consequently scoring of specific parameters by the paper purchasers
- Aggregates the scores to a total score, which should allow a comparison of different suppliers and support decision making for paper buyers

Characteristics:

- The system operates on a webserver that allows reporting and making available specific environmental information to specific customers.
- The detailed description of the system is currently not freely available (only after registration, which is not free of charge)
- The utilisation of EPAT is not free of charge
- EPAT is not popular on the European Market

9.3 EPDS [Environmental Profile Data Sheet]

Background:

- Origin: TerraChoice environmental marketing, Canada
- Sponsors: Forest Association of Canada (FPAC)
- Last Update: 2004
- Used: mainly in Canada, USA
- Further information: **www.terrachoice.com**

Main functionalities:

- Standardised and very detailed environmental data collection sheet for paper products covering also indirect emissions and transports

Characteristics:

- If fully implemented, it delivers an almost complete set of environmental data (includes even indirect emissions from production and transport of relevant chemicals)
- No support for the interpretation of the data is included
- The EPDS is not popular within the European paper industry
- The utilisation of the EPDS is not free of charge
- 3rd party verification of the data is obligatory (data has to be submitted and becomes reviewed and also audited)

9.4 WWF Paper Scorecard

Background:

- Origin: WWF International
- Sponsors: WWF
- Last Update: 2007
- Used: global
- Further information: **http://www.panda.org/how_you_can_help/greenliving/at_the_office/reducing_paper/paper_toolbox/tools_for_paper_producers/wwf_paper_scorecard_and_manual/**

Main functionalities:

- Standardized environmental key-data collection sheet for paper products
- Provides a rating/weighting of individual parameters and aggregation to a total score, which should allow a comparison of different products and support decision making for paper buyers

Characteristics:

- Rating/score is based on a defined set of key performance parameters
- Regarding emissions a score is only provided for highest performance
- Regarding forest certification a score is only provided for FSC

10. REVIEW
IMPORTANT EUROPEAN ECOLABEL STANDARDS FOR PULP AND PAPER PRODUCTS

10. REVIEW IMPORTANT EUROPEAN ECOLABEL STANDARDS FOR PULP AND PAPER PRODUCTS

The following chapter should provide an overview and brief understanding of the Ecolabel standards, that can be considered as relevant nowadays for pulp and paper products in Europe.

10.1 Nordic Swan Ecolabel

Background:

- Origin: Scandinavian Ecolabel (Norway, Finland, Sweden, Denmark)
- Sponsors: Nordic Ecolabelling, Nordic Council of Ministers
- Last Update: October 2003/March 2005
- Used: Mainly in Europe, especially in Scandinavian countries
- Further information: **http://www.svanen.nu**

Characteristics:

- Provides an Ecolabel for Printing and Graphic paper, which defines certain criteria in terms of clean production (air and water emissions), energy efficiency, used raw-materials and chemicals
- Broad acceptance in Europe and esp. in Scandinavia
- The Nordic Swan criteria are very similar to the EU Flower criteria
- Products that meet the EU Flower criteria are automatically approved to be also Nordic Swan compliant
- It is possible not to apply for the label but to proof compliance so that the product can be used for production of labelled products by other producers

10.2 European Ecolabel [EU Flower]

Background:

- Origin: European Ecolabel (EU)
- Sponsors: European Commission
- First Launch/Last Update: 1999/2003
- Used: Mainly in Europe
- Further information: **http://www.eco-label.com**

Characteristics:

- Provides an Ecolabel for Printing and Graphic paper, which defines certain criteria in terms of clean production (air and water emissions), energy efficiency, used raw-materials and chemicals
- The EU Flower criteria are very similar to the Nordic Swan criteria
- Products, that meet the EU Flower criteria are automatically approved to be also Nordic Swan compliant

10.3 The German Ecolabel [Blue Angel]

Background:

- Origin: German Ecolabel
- Sponsors: German Federal Ministry for the Environment, German Environmental Agency, RAL
- First Launch/Last Update: 1978/December 2006 (RAL-UZ 14)
- Used: Mainly in Europe, especially Germany
- Further information: **http://www.blauer-engel.de**

Characteristics:

- Provides an Ecolabel for Printing and Graphic paper from 100% recycled fibre, which defines certain criteria in terms of used raw-materials and chemicals
- The Blue Angel is very popular for recycled products in Europe
- No criteria regarding energy efficiency and emissions to water and air
- Only applicable to 100 % recycled paper products

10.4 The NAPM Recycled Mark

Background:

- Origin: The National Association of Paper Merchants of UK
- Sponsors: The National Association of Paper Merchants of UK
- First Launch/Last Update: -
- Used: Mainly in UK, Europe
- Further information: **http://www.napm.org.uk/recycled_mark.htm**

Characteristics:

- Provides an Ecolabel for paper produced from either 50, 75 or 100% recycled fibre
- Besides the criteria regarding recycled raw-materials there are no other criteria (e.g. regarding energy efficiency, emissions to water and air, chemicals, etc.)

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Cover printed on Novatech Matt 300gsm
Text pages printed on Novatech Matt 150gsm